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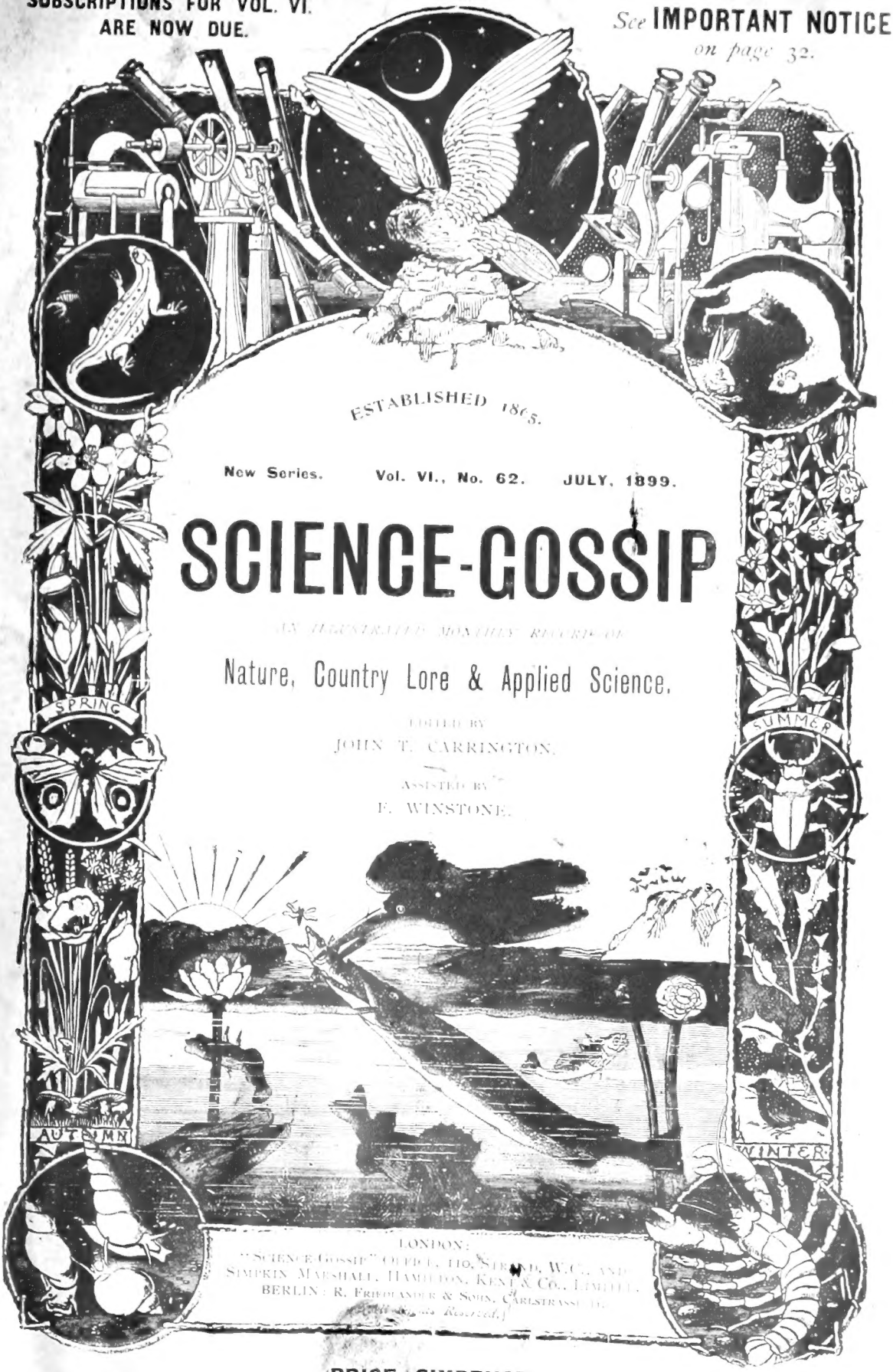

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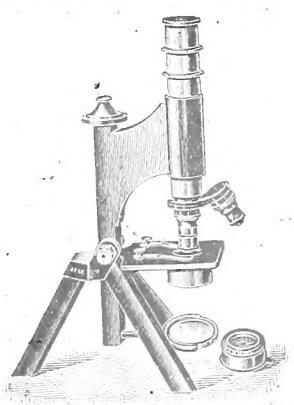

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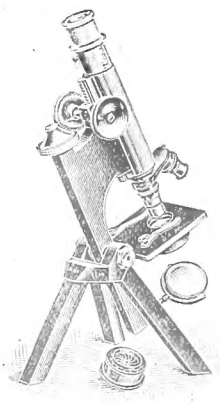

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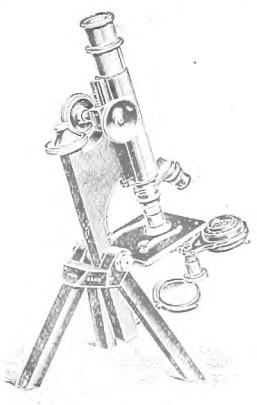

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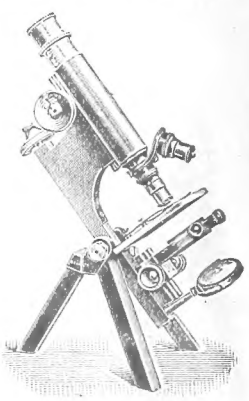

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MEMORIES OF CALYPSO'S ISLE.

By John H. Cooke, F.L.S., F.G.S.

THE Maltese Islands have of late years become very popular as a winter resort, and thousands of visitors now reach their shores annually, in quest of the balmy, health-giving air which the "tempo del diavolo" and "tempo sporco" of other countries fail to supply. The islands, however, have something more to offer besides climate and social advantages. They teem with mythological lore, and with prehistoric and mediaeval relics of the many nations who have, from time to time, controlled their destinies. The vicissitudes through which they have passed since the Phoenicians first landed on their shores three thousand years ago, possess a spice of romance which strongly attracts wayfarers, and excites the enthusiasm of all interested in classical and mediaeval history.

The Giants' Tower, Gozo.

A little more than an hour's run from Valetta, the capital of Malta, lies Ogygia, in modern parlance Gozo. It is a small island, which has been immortalised by Ovid in his fifth book of the Iliad, and by Fenelon in his "Adventures of Telemachus" as being the place where the goddess Calypso and her nymphs held court, and the scene of the shipwreck of Telemachus. To modern geographers it is better known as Gozo, corrupted by the Arabs from the name Gaulos, given to it by the Greeks two thousand years ago.

The scenery of Gozo is both varied and picturesque. For nine months of the year the country is covered with a rich mantle of corn, cotton, grapes and melons. Towards the centre of the island the long-drawn undulations of the plain, which lead up from the shore-line, gradually melt into the slopes of the plateaux. These again sink away in the distance into broad fertile valleys, forming a setting to the emerald green waters of the baylets that fringe the shore-line. The contrasts which the scenery of the island affords are striking and varied. They offer a wealth of material alike to the geologist, the botanist, and every other lover of nature.

From the quaint little hamlet of Sciarra, where the love-stricken Calypso held her court, a fine view of the topography of the island is afforded. To the east lies the pyramidal-shaped hill of Inna Torra with its old Phoenician temples and tombs. Bounding it on either side are two small ravines, which, on the western slopes, coalesce and form the delightful valley of Uied el Ramla, where the headstrong Ulysses and his faithful Mentor planned their escape from the seductive intrigues of the goddess nymph. Away to the east extends its precipitous but well-cultivated slopes, dotted with locust and fig-trees, and patched with luxuriant crops of clover and rye-grass. These under the influence of the light southern zephyrs sway to and fro, presenting kaleidoscopic changes of colour, that vary in the sunlight from a rich crimson to a richer purple, and graduating through every conceivable shade of a golden yellow return to their crimson and purple.

The island abounds with reminiscences of old-

world habits and customs. On the slopes that lie beneath Sciarra stand the ruins of the Torre Gigantea, a Phoenician structure of barbaric design and colossal proportions, the origin of which has been ascribed by the oracles of the peasantry to the fabulous one-eyed Cyclops.

The temple has been laid out in an elaborate, but roughly symmetrical plan. Its walls are massive, and are formed either with cyclopean blocks piled one on the other, or rows of enormous slabs standing on end. The various chambers have been arranged so as to allow of the edifice assuming an elliptical, or egg-shaped form. They are connected the one with the other by means of doorways, the portals and arches of which are ornamented with small circular indentations, symbolical of the starry heavens. Save that many of the outlying courts have now disappeared, the temple is much the same as it was 3,000 years ago when the Phoenician priesthood solemnized their first ceremonies within its walls. Its stones are greyer. The storms of centuries and depredations of the goat-herds and the vandalism of tourists have displaced or destroyed some parts of the structure; but with these exceptions the edifice is still substantially the same.

The uncouth, roughly-hewn stones are invested with a melancholy charm such as would be sought for in vain in more modern and pretentious ruins. They stimulate the imagination with their old-world associations and memories, and, as long as a bond of union exists between science and her handmaid art, so long will these hoary relics of a lost people have a fascination for all thinking minds.

The folk-lore of the peasantry locates the scene of Ulysses's shipwreck on the shores of the little bay that lies beneath Sciarra, and it points out a cave that is situated on the same hill, as the place in which he was detained for seven years by amorous Calypso.

Viewing Calypso's Cave as it now appears, it would seem that Homer's knowledge of forestry and of botany was about equal to that possessed by the average descriptive writer of modern times; too much reliance should not therefore be placed on his free use of pre-Linnean lists.

Where, the visitor to the "Flor del Mondo" might ask, are now the "groves of poplars" and "of alders," "the limpid fountains" and the "mazy windings of the rills." The grotto itself is but a small, common-place rock excavation. The stern reality is rendered all the more disappointing on account of the glowing description with which the poet has immortalised it, and the historical halo in which it is enshrined. The vicinity is, however, very charming. A swarded olive grove lies immediately beneath, and the bright green grass dappled with the shadows of the olives, contrasts prettily with the more sombre colourings of the caroubas around. In the evening when the setting sun shoots its rays athwart the valley and lights up the sculpturing of the cliffs and pinnacled crags of Inna Torra, bathing them in a flood of softened glory, the view from the mouth of the grotto is exquisitely beautiful.

It is not easy to understand why this cave should have been selected by tradition as having been the abode of the nymph queen, when there are so many fine caverns in the immediate vicinity. One of these, which is situated but a few hundred yards away, is specially interesting. Suspended from its roof, like icicles after a severe frost, are thousands of crystalline semitransparent stalactites the colours of which range from a snowy-white to a deep golden yellow. Through the roof and sides of the cavern a never failing supply of lime charged water slowly finds its way, and decorates with living pearls the pendants and traceries that hang around. When the light of the tapers falls on these and on the fantastic arcades and columns that are attached to the roof and sides, the reflections shed a softness and mellowness around, causing the background to appear as though it were hung with the most delicate of crystalline draperies. The whole is very charming and fairy-like, so much so it almost makes one regret that the Gozitans were not more discriminating, when they assigned the abode of the goddess a place in their folk-lore. The hills and seacliffs of both Malta and Gozo are honey-combed with retreats such as these; always away from the beaten tracks, but nevertheless easily accessible to those who do not begrudge a little labour in reaching them.

Mediterranean sunsets are famed for the gorgeous softness of their colourings, and for the grandeur of their effects. Beautiful from any part of the islands, on the Sciarra mount they seem to have lent to them additional and indescribable charms. Above the rich purple undertones of colour of the massive cliffs of Ras il Dimitri, the sinking sun fires the peaks that fringe the western horizon, shooting forth into the wondrous, filmy, vaporous clouds that cap their summits, strong bars of red and yellow and less vigorous rays of more subdued tints. They present a mass of colouring the adequate description of which is quite beyond the power of the pen. Among our painters Turner's efforts probably approach nearest to the original; among our litterateurs Mark Twain's simile that a Mediterranean sunset is "like a tortoise-shell cat having a fit in a dish of sliced tomatoes" is not at all an inapt one.

Very few tourists penetrate to the north-western parts of Gozo, the most attractive and picturesque district in the Maltese Islands. The region has been much broken up by earthquake shocks, and the scenery therefore is varied, rugged and weird. The little bay of Cala Dueira is of special interest to lovers of the picturesque. On its shore-line lies a huge circular depression which has been formed by the subsidence of the roof of an enormous cavern. On three sides, the depression is surrounded by vertical cliffs that descend sheer, without a break, into the the waters of a lakelet that lies in the bottom. The shore on the southern side shelves from the mouth of the gorge to the base of the opposite bluff. A broad bank of pearly white limestone pebbles extending over the bottom of the hollow, causes the waters to seem to shallow, and thus gives them the appearance,

in calm weather, of a huge mirror in a rocky framework of engirdling cliffs.

The lakelet is such only in name. On the northern side its waters are connected with the Mediterranean by a long tunnel. This, the waves, raised by the Maestrale, have ploughed through the massive coast cliff, and, through it, in the winter time, the storm waves surge in impotent fury, converting the hollow into a cauldron of boiling, seething foam.

Away to the south of Dueira lies a typical Gozitan hamlet, with its quaintly-gabled houses, and its clusters of Phoenician rock tombs. Many of the tombs have been destroyed by the peasantry, but sufficient of them remain to show that Ghar Gherduff and San Giorgio were not the least important of the numerous Phoenician burying places that lie scattered over the islands.

Right and left of these old-world settlements, the view of the Mediterranean is obstructed by mural crags of grey limestone, that tower to a height of 400 feet above the waters of the little bay of Dueira. These cliffs rise, regular but abrupt, their crests broken, perforated and rendered fantastically rugged, with a profuse growth of spurge and trailing clusters of the Leguminosae.

Of sights, such as one would expect to find in the more popular resorts of Europe, Gozo is poor indeed; but in tradition, historical association, and undefiled nature, the Hyperia of the poets is without an equal.

Ravenswood Road, Redland, Bristol.

BUTTERFLIES OF THE PALAEARCTIC REGION.

By Henry Charles Lang, M.D., M.R.C.S., L.R.C.P. Lond.

(Continued from page 5).

Variation.

THE subject of variation is one of great importance. We have to draw a line between accidental varieties and local varieties, or races. The first are designated by the term aberration (*ab*), and signify those varietal forms which are found in the same localities, at the same season, and conjointly with the ordinary form. Some of these aberrations are produced constantly: such as *Thais medesicaste*, ab. *honoratii* B., *Colias edusa* ab. *helice* Hb., *Argynnis adippe* ab. *cleodoxa* O. Other aberrations occur sporadically as individual forms, and some are either very rare or else almost unique, as for instance *Vanessa polychloros* ab. *testudo* Esp., *V. antiopa* ab. *hygiaea* H. True varieties or local races are those forms which more or less replace the typical form of the species in particular localities, *e.g.*, *Papilio podalirius* var. *feisthamelii*, *Anthocharis tagis* var. *bellezina*, *Melitaea aurinia* vars. *merope* and *provincialis*, *Lycaena eros*, var. *eroides*, *L. astrarche* var. *artaxerxes*.

It must, however, be borne in mind that variety and aberration are not constant zoological terms; what is in one place a true variety, may occur elsewhere as an aberration. For example, the form of *Apatura ilia* called *clytie* is sometimes a variety, and in some places may occur with the type, as an aberration. Some forms that are at present accepted as varieties, are, perhaps, distinct species, or in process of becoming such in time. For these Dr. Staudinger has employed the term "Darwinian species," after our great exponent of the law of evolution. I shall enumerate several of these as distinct species, especially in such genera as *Parnassius*, *Colias* and *Melitaea*. In many alpine varieties there is probably a reversion to a primitive boreal type, such as in *M. aurinia* var. *merope*, *Pieris napi* var. *bryoniae*, etc.

Seasonal Dimorphism.

By seasonal dimorphism is meant that in species which undergo their transformation more than once in the year, there is frequently a marked difference in the appearance of the broods. This condition is much more universal than was formerly supposed. In tropical species wet and dry season forms are often strongly differentiated; and in the Palaearctic species the spring and summer broods frequently exhibit constant difference. These seasonal forms are usually treated as varieties by modern entomologists. They are the result of differences in climatic influences. We see in some of our common British species, such as *Pieris napi*, examples of this divergence. In many Continental species it is very marked, especially in the case of *Vanessa levana* L., where the spring brood differs entirely from that of the summer, insomuch that Linnaeus gave them two distinct specific names. The latter is a black butterfly, with white bands; the former fulvous brown, with black markings.

Sexual Dimorphism.

In some species the female exhibits several forms differing in coloration and sometimes in pattern; these forms are treated as aberrations. Examples may be seen in the female aberrations of *Thais deyrollei* and *Thecla fasciata*, where several forms are found. The ab. *helice* of *Colias edusa* is a very well known example, which is followed by many species of the genus, such as *C. aurora*, *C. myrmidone*, *C. erate*, etc. This tendency in the genus *Colias*, towards a whitish ground colour, replacing the usual yellow or orange in the female, is very probably due to a reversion to a primitive coloration. It is a remarkable fact that in some species of the genus, the females are always of a light colour, whilst the males are yellow or orange.

The ab. *valezina* of *Argynnis paphia* is another example of female dimorphism. In England this form is chiefly confined to the New Forest, in Hampshire, but in Switzerland and Germany it is not uncommon. What in *Argynnis paphia* is an aberrant form, is the normal condition of the female in some species of *Argynnis*. In *A. sagana* for instance, the wings are always of a dark greenish brown, with white markings; while the male is very similar on the upper side to *A. paphia*. The female of *A. sagana* bears a strong superficial resemblance to an *Apatura*, and this arrangement of pattern may possibly be in obedience to that protective law of nature, which is so marked in the mimetic dimorphism, in the females of many tropical species.

In *Hypolimnas misippus*, which is a Palaearctic species, the female is totally unlike the male, mimicking (as its name implies) the appearance of a *Danais*, the members of which genus are distasteful to birds.

I will say nothing further here of protective mimicry and coloration, as this subject has been treated frequently of late in popular works, but I will pass on to the consideration of structure and anatomy of Butterflies, as we shall necessarily have to refer constantly to these in the following articles.

External Structure.

A butterfly in its structure follows the general rule of the sub-kingdom to which it belongs, Arthropoda or Entomoida. The skeletal parts are external, and are named exoskeletal. The viscera, vascular and nervous systems, as well as the muscles, are internal to these. The wings, which are the most conspicuous parts of a butterfly, are in reality but appendages to the exoskeleton, and are in themselves, when in a fully-developed state, extra-vascular and devoid of sensation; though it is probable that the nervures of the wings at first act as blood vessels, and afterwards when the wings are dry perform the functions of respiratory tubes.

The body of a butterfly like that of other insects, is divided in segments or somites, and consists of the following primary parts—

(A). The Head.

The head theoretically consists of three segments, containing the palpi (*a*) the proboscis or haustellum, (*b*) a long spiral tongue for sucking honey or other liquids on which the perfect insect feeds. This is sometimes of great length, but when not in use is curled up spirally on the under surface of the head. It really consists of equal halves, joined in the middle.

The eyes (*c*) placed one on either side of the head. They are proportionately large globular bodies, immovable, but containing a number of separate and distinct optical organs, each having its own lens and nerve supply. This kind of eye is that which is known as compound.

The antennae (*d*), are very important organs in all insects, and are well developed in butterflies. They consist of two parts, the shaft (*d'*) and club (*d''*). They are the organs of touch, and perhaps of special senses equivalent to smelling and hearing. The extent of their functions is but little understood, and most probably varies in different orders of insects. In some of the social Hymenoptera they are evidently used for communicating intelligence from one individual to another.

The antennae are always clubbed in butterflies, and this feature forms one of the zoological characters of the group; from which indeed it receives its name of Rhopalocera or "club-horned." The club is generally ovoid in shape, but in some genera it is somewhat cylindrical or resembles an inverted cone. In many Hesperidae it terminates in a hook-like process.

(B). Thorax.

The thorax consists of three segments, viz., prothorax (*a*), mesothorax (*b*), metathorax (*c*). On the thorax are placed the organs of locomotion, a pair of legs being attached to each segment (E). The legs consist of femur or thigh (*a*), tibia (*b*), tarsus containing three joints (*c*) and claws (*d*). Sometimes the tibia is armed with spines near to its articulation with the tarsus. In some families of butterflies, as Apaturidae, Nymphalidae and Satyridae, the anterior pair of legs are often imperfect in their structure; especially those of the males.

The wings, which are shown on the left hand of the diagram, consist of two pairs, fore-wings and hind-wings, sometimes called anterior and posterior wings. They are attached to the meso- and meta-thorax respectively. They are always more or less triangular in shape, and their margins are named as in the accompanying figure. The *base* is at the insertion with the thorax, the front margin is called the *costa*, the other two margins are called *outer* and *inner*, though some writers speak of the outer margin as the hind margin. The point of junction of these two margins is known as the *anal angle*. Sometimes the wings are more rounded as regards outline, than those in the figure, and often more indented or angulated.

In the genus *Papilio* the outer margin of the hind-wings is prolonged at the point *d''* into a tail-like appendage. In many of the Lycaenidae the hind-wings develop one, or even two, very small tails on the outer margin. In *Charaxes* there are two well-marked prolongations of this kind on the hind wings. In the genus *Sericinus*, the tails of the hind-wings are greatly elongated, so as to produce a striking effect. The object of these additions to the ordinary structure of the wings does not appear to admit of any explanation.

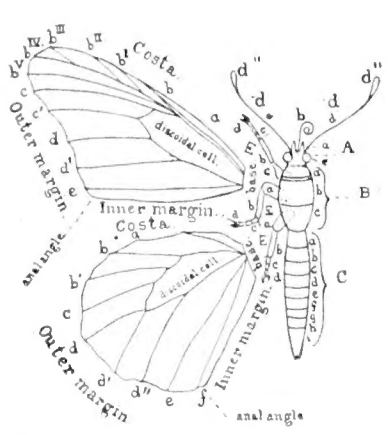
The wings of butterflies are of a membranous character, formed of chitinous substance, of the same material as the exoskeleton, supported by ribs or "bones" of the same substance. These last have received the name of nervures, though they are not in any way connected with nerve substance. Their arrangement is well defined, and is of extreme importance in classification. The nervures are named as follows—(*a*) The *costal nervure*, running from the base of the wing into the costa. This as will be seen in the figure is very short in the fore-wing, and

much longer in the hind-wing; (*b*) the *subcostal nervure* is immediately below. It gives off several branches, generally four or five on the fore-wings, but sometimes less. These are called subcostal nervules (b^{I}, b^{II}, b^{III}, b^{IV}, b^{V}). On the hind-wings the subcostal only gives off one secondary branch; or rather, itself bifurcates.

Below the subcostal nervure is a large space called the *discoidal cell*. It is formed by the subcostal above, and the median nervure below. This space is sometimes closed at its outer end by an anastomosis of these two nervures, as shown in the figure, though at other times it is open. The discoidal cell is closed in Papilionidae, Pieridae, Danaidae, Satyridae, and in some genera of other families.

From the discoidal cell, or prolonged from the *submedian*, two nervules are given off on the fore-wing and one on the hind-wing (*c*, *c'*). These are called upper and lower discoidal nervules.

Next is the *median nervure* (*d*), giving off one median nervure in the fore-wing (*d'*) and (*d' d''*) on the hind-wing. Below this is the *submedian* nervure (*e*) which is without ramifications. Lastly the *internal nervure* (*f*) which is either absent, as in the figure, from the front-wing, or else is very short.



Terminological Diagram of Butterfly.

The wing-membranes themselves are furnished with minute depressions or sockets, arranged in regular rows. Into these are inserted the scales, that clothe the wings, and which give the name to the order Lepidoptera or "scale-winged" insects. The scales are usually placed closely together, overlapping one another like the tiles on a roof, giving a dense clothing to the wings. The scales are usually of an ovoid or oblong form, at times truncated at the upper end, and occasionally dentated or serrated. Sometimes they are elongated. They are furnished at the inferior extremity with a stalk or short process by which they are inserted in the wing follicle or socket. The body of the scale is said to consist of two layers of membrane between which are exceedingly minute particles of pigment granules. The surface of the scales is sometimes striated in such a manner as to produce the effect of iridescence, or fluorescence, by their refracting action. To this we may attribute the beautiful iridescence we see in *Apatura iris*, and some other species. Also the metallic effects of the silvery decorations in genera such as *Argynnis*, and the brilliantly shining colours of many of the Lycaenidae. The scales themselves are so minute, when examined by the unassisted eye, as to resemble grains of dust; but their form is apparent even under a low-power microscope.

Most butterflies have their wings densely clothed with scales, though some are but sparsely provided with them; as in the genera *Parnassius* and *Doritis*. Among the Palaearctic Butterflies, there are no actual "clear wings" like some of the Tropical Heliconidae, Pieridae, and also Erycinidae and Satyridae.

In *Thais rumina* and *T. medesicaste*, there are transparent patches near the apex of the fore wings, and some of the Siberian Hesperidae have nearly transparent markings.

The arrangement of the colouring and pattern of the wings is very various. Sometimes it has relation to the neuration, but very often not. When this is the case, the design is in the form of lines, as in *Papilio machaon*, many Pieridae, *Danais crippus*, etc.

Marginal and sub-marginal borders and bands are very common, as again in *P. machaon*, the genus *Colias*, etc. Fasciae or bands of colour crossing the wings are often seen, as in *Limenitis sibylla* and *Vanessa atalanta*, etc. Occasionally, a patch of colour is spread over a large portion of the wing area, as in *Rhodocera cleopatra*, and in the females of *Thecla quercus*.

The apices of the fore-wings are often marked with white spots, as in many of the Nymphalidae. Spots are indeed the most common form of markings. These are either rectilinear in outline, spherical, or ovoid. They are sometimes spread over the whole surface of the wings as in *Thais*, *Melitaea* and *Argynnis*, usually, however, they have a limited and definite disposition; a spot in the discoidal cell being characteristic of many genera. For example, the black spots in the discoidal cell on the underside of the genus *Lycaena*, and the single red spot seen on each wing of *Rhodocera rhamni*. Very commonly spots are disposed in rows running parallel with the outer margins of one or both pairs of wings. This is seen in genera too numerous to mention. Ocellated or pupilled spots are very common, especially in the Nymphalidae, Lycaenidae and Satyridae. In many species there is a well-marked ocellated spot near the anal angle of the hind-wings. In the genus *Parnassius* annular spots, generally red in colour, are nearly always present on the hind-wings. Lunules are spots of a crescentric shape, and are usually disposed in rows parallel with the outer margin.

Metallic silvery markings are found on the underside of many Lycaenidae as in *Cigaritis* and *Lycaena*. In the latter they often form the centres of the submarginal spots of the hind-wings. These have received the name of "peacock eyes" from some writers. It is, however, in the genus *Argynnis* that the silvery markings are most evident. They generally take the form of blotches or spots, differently disposed on the wing area, and mostly

confined to the underside of the hind-wings. *Argynnis latona* is perhaps the best-marked and most beautiful example. In a few species of this genus, among which are *A. paphia* and *A. pandora*, the silvery markings take the form of stripes. Metallic submarginal lines are sometimes formed on the underside of the hind-wings in the genus *Coenonympha*. Among the Hesperidae, the genus *Carterocephalus* affords examples of distinct silver spots in three Palaearctic species, *C. argyrostigma*, *C. gemmatus*, and *C. christophi*. The discoidal spot on the underside of the hind-wings of several species of *Colias* is often distinctly silvery.

The wings of butterflies when at rest are mostly brought together over the back, except in the Hesperidae where the fore-wings are flexed in a downward direction as in most Heterocera.

(c.) Abdomen.

The last division of the body is the abdomen, consisting of nine segments (*a*—*i*). It is elongated, but not beyond the outer margin of the hind-wings in any Palaearctic species. In the Papilionidae the inner margin of the hind-wings is cut away, as it were, to allow freedom of movement. In all other families the portion of the wing on either side, between the internal nervure and the inner margin, is everted; so as to form a channel or groove in which the abdomen rests. The abdomen is most frequently of the same colour as the thorax; and generally dark brown or black, but sometimes of the prevailing colour of the wings as in many of the Lycaenae. It is usually clothed with hairs, sometimes densely so, as in *Parnassius* and *Vanessa*. The last segment contains the genital armature, and in some genera, as in *Luedorfia* and *Parnassius*, the female exhibits a curious pouch-like appendage, the origin and use of which is unknown.

(To be continued.)

INSTINCT.

By R. Dickson-Bryson, B.A., F.P.S., F.R.As.S.

(*Continued from page* 12.)

In Ants.

No other insects display so much versatility in their habits as the ants. Like bees, they are social, and the colony is composed of individuals of different natures. While the general plan of the bee-hive is unique, the domicile of ants is distributed into several departments, according as the ants are carpenters, miners, or masons. These departments have not the elegance and the regularity of the hive, but they are of ample capacity and convenient arrangement. An amazing skill is shown in the disposition of the materials of construction, so as to secure complete stability. In the erection of arches the ants display as much skill as our ablest engineers. The most varied materials serve their purpose, such as grains of wheat, blades of grass, fragments of wood, and the remains of slaughtered insects. Not anything is despised, provided the shape, dimensions, and rigidity are suitable. Frequently they modify their processes and take precautions which seem to show that they are not under the absolute sway of instinct. Only the wood ants in this country employ the several materials enumerated. The black ants do not use anything but earth, of which they make the pillars and walls of their dwelling. The carpenter ants saw, plane, and polish the wood required for their purposes. These miniature planks are about the thickness of a visiting card. The building operations of the three species are carried on in stages.

Ants are underground dwellers, and they congregate in vast numbers to perform their several tasks, but notwithstanding their inter-communal habits, they neither borrow nor imitate. Each performs its own work efficiently. This is all the more remarkable, seeing there is little or no difference in their size, or in their instruments of construction. The merely organic differences so far as we know them, are inadequate to explain the anomaly. It is clear that instinct is neither modifiable nor transmissible, even among allied species. They are very devoted to their young, and fondle them with all the affection of which they are capable. They wash, feed, and in good weather lead them out for airings. If, during these excursions, any danger threatens, they seize them in their mandibles and carry them off without hurt. The bodies of these young ants, be it remembered, are delicately soft, while the mandibles of the parent are hard, sharp, and formidable, yet the young are held in position without the slightest injury.

Ants evince a marked taste for the liquid produced by various aphides, or plant-lice, and their manner of treatment of the aphides to secure this coveted liquid is worthy of note. They have well-organised aphis hunts, setting out in vast hosts to explore the country in their vicinity. When they have found the object of their search they introduce themselves with the most bland winsomeness. Once in their possession, they take every care of the aphides, and woe to the intruder that would interfere.

Examine a tree infested with aphides and you will probably discover a number of ants running along its length. Observe them closely and you will be the witness of an interesting manœuvre. An ant cautiously approaches the aphis, and gently intimates its presence by drawing its antennae along the back. This appears to be a flattering mode of treatment, and one that cannot be resisted by the tiny aphis. Soon

drops of a whitish liquid form at the extremities of the appendices, a phenomenon bearing a striking analogy to the milk squirming from the mammae of a cow. The ant is simply milking the plant louse, consuming the liquid with keen appreciation. Each ant goes through the same performance with several more aphides, then it gorges itself with an ample supply, and carries some off to share with the young

The ants go further: they sometimes drive a herd of plant lice to their quarters, so as to have them handy for future use. This requires the ants to construct a sort of stable for their convenience, and to provide them with suitable food. They behave towards their "cows" exactly as a good farmer does towards his cattle, and for the same reason, that by proper care and attention they may increase the value of their stock. When the stable is constructed the ants sally forth in a body, and having sighted their prey, each ant approaches an aphis, probes it softly until it abandons the leaf from which it is sucking the juice, then seizing it gently by the middle of the body the ant carries off the aphis in triumph, though it may be many times its own size. Should a plant louse offer any resistance, which they do sometimes, the ant slightly stupefies it by subcutaneously injecting an acrid fluid, known to chemists as formic acid. Under its influence the aphis loosens its grasp, and is carried off. Having reached their quarters, the ants omit nothing that will tend to the comfort of their captives. After a little time the aphides get used to their new conditions, and settle down to their lot with perfect content. By-and-by, as they grow old and useless they are replaced by others, but on the whole the ants appear to be no less tender in their treatment of the aphides than of their own young.

Casual observers might see some evidence of intelligence in the ant's behaviour towards the aphis. We must, however, admit that their sagacity, though exemplary, is too uniform. Their affection is always the same, their tenderness ever patient, their kindness never decreasing, their devotion never relaxing. So many virtues without a single vice are not met with among other creatures. We must find the cause elsewhere than in a hypothetical will, and for the present we fall back on instinct.

All ants are not pastoral, peaceful, laborious, and economical in their habits. There is a warrior race of ants. They attack other ants to possess themselves of their young—of which they make slaves. The warrior ants seem to have all the vices of man. In their infancy and youth they are perfect models of goodness, but as soon as they reach the adult state they wantonly abandon themselves to their ferocious instincts. The warrior ants have well trained armies, and they go to war with other ants of their species, not as a tumultuous mob, but in perfect order under the control of a leader. Their ranks may straggle on occasion, but they are never confused. As soon as they reach the enemies' camp, the attack commences, and the process of war is that of other battlefields. The struggle is deadly and savage, and the massacre fearfully complete. It is a veritable battle, with all its horror and repulsiveness. There are dead, dying, and wounded scattered over the miniature theatre of war. It is not possible to witness the affray without feelings of compunction, and the query forces itself upon us, is this war the normal condition of terrestrial creatures? The battle over, the warrior ants rush through every opening into the city. They put to death the guards, take possession of the larvae and carry them off. These baby captives are destined by-and-by, to be the slaves of their conquerors.

The captive larvae having reached the adult state, attend to the wants of their masters, and take care of them as if they were children; so well indeed, that the conquerors are virtually the slaves, because they are incapable of administering to their own wants, and would die of starvation but for their faithful little slaves. Strangely enough, these slaves make no effort to secure their freedom, which they could easily attain. They seem to feel themselves, as it were, members of the community. The condition of these little slaves, one must say, is ameliorating, and we never find among them as among men, despotism on one side, and subjection on the other, their association being mutual and free. I have even seen, during a migration, the masters carrying their slaves. We see instinct here, in the fact that warrior ants never become slaves. Their occupation is war only, no other species has the same habit. The warrior ant is a soldier born, but he cannot instruct his captives in the art of war. Men alone pass through the alternatives of war and peace, and are sometimes conquerors, and sometimes captives. With men alone, is war an art, of which the tactics and engines vary with his knowledge. War has its laws which all ought to know to some extent. Man triumphs through his intelligence; by the intellect, he conceives, and according to those conceptions, he plans war and fashions his implements. The warrior ant always conquers by the same means, and with the same end in view. It does not fight for a principle, and knows no glory. It performs a function to which it is condemned by the fatality of its organisation and instinct.

(To be continued.)

"TANDEM BUTTERFLIES."—The modern scramble among newspaper writers for the sensational, has landed at least a couple of London Newspapers, into a lamentable exhibition of ignorance, each of these papers has recently illustrated a "tandem butterfly." Not satisfied with perpetuating in all seriousness a ridiculous joke, they show that there is not a single person on the literary staff of these newspapers, who knows the difference between a butterfly and a moth. The figure, evidently drawn by one uninitiated in the natural history of insects, depicts a bombycoid moth with a long interval of body between the front and hind wings. This by no means makes a "tandem" butterfly. It reminds one of the anecdote of the late Professor Westwood, who, on being invited to name an insect beautifully built up of pieces from various orders, at once identified it as a bug—a "humbug."

BIBLIOGRAPHY FOR BEGINNERS.

By John T. Carrington.

IT has occurred to me, in consequence of not infrequent requests for information, to write a series of short articles under the above heading. The intention is that they should serve as inducements to encourage naturalists to commence studies with which they are unfamiliar. I believe that an absence of knowledge of the literature referring to any branch of natural or physical science, is one of the greatest deterrents in taking up its investigation. I shall, therefore, give from time to time a list of such works as will be found useful in the particular section under consideration; commencing with quite beginners' books, and leading the student to those of more technical character. Of course there are many books on the respective subjects to be consulted later; but my object is to give working lists of those most necessary at the commencement.

Should the intending student find difficulty in obtaining these works, we shall be pleased to get them on request, and forward them from this office, carriage paid, at their published prices. To this, there will be some few exceptions, which must be a matter of arrangement, when the book is out of print, or for other reasons.

I will commence with the

Mollusca.

In former times the general term Conchology was applied to the study of Mollusca. That term, however, is now only used with regard to the shells of these animals, while Malacology is the accepted word to cover the study of the animals, their structure, habits and shells.

The British student of Malacology may consider the subject as divided into four sections. Section 1 applies to our insular fauna, which may be divided into the land and freshwater species and those of our seas. Section 2 to the study of the Mollusca of other parts of the world. Section 3 to classification. Section 4 to the morphology or structure, including anatomy of Mollusca in general; and to the investigation of the habits of various species.

Commencing with the first Section:—

Lionel Ernest Adams, *The Collector's Manual of British Land and Freshwater Shells*, published by Taylor Brothers of Leeds at 10s. 6d., is the most convenient and trustworthy beginner's book on the British species. The second edition, issued in 1896, is the best, as the nomenclature is more nearly brought up to date. It contains coloured plates and instructions for collecting and preservation of mollusca. With plain plates it costs 8s.; coloured, 10s. 6d.

Lovell Reeve's *Land and Freshwater Mollusks Indigenous to, or Naturalized in the British Isles*, though published in 1863 is still in many ways one of the best works upon the shells of which it treats. The species are illustrated by vignettes of the animals, and woodcuts of the shells. There is a fairly full synonymy of nomenclature. It has long been out of print, but can be got second-hand for about 10s. 6d.

Dr. William Turton's *Manual of the Land and Freshwater Shells of the British Islands* has coloured plates which are useful for identification. The nomenclature in many instances is not that now used. The edition of 1857, edited by Dr. Gray, is the one to obtain. It is now sold second-hand at about 7s.

Richard Rimmer's *Land and Freshwater Shells of British Isles*, with 11 plates of photographic illustrations, published in 1880, is useful for identifying some of the smaller species. It was issued at 11s., and sells second-hand at 3s.

Dr. Gwyn Jeffrey's *British Conchology*, issued in 1862-69, five vols. with 147 plates, is a standard work on the British mollusca as a whole, the last four vols. containing the marine species. It was published at £4, and now at second-hand commands £2 18s. for the plain plate edition and £5 5s. for that with coloured plates. Vol. I., containing the land and freshwater species, may be obtained separately with plates at 12s.

Another important work, a *History of British Mollusca and their Shells*, four vols., issued in 1853 by Edward Forbes and Sylvanus Hanley, may be had second-hand, plain plates at £4 and coloured, £10.

The British nudibranchiate mollusca are best studied by Alder and Hancock's *Monograph of the Nudibranchiate Mollusca*, published by the Ray Society in 1845 with handsome coloured plates. This may be obtained for about £2 10s. second-hand.

John William Taylor's *Monograph of the Land and Freshwater Mollusca of the British Isles*, will, when finished, be a standard work on the British species. It is being issued by Taylor Brothers, of Leeds, at 6s. per part. The first was out in 1894. They come at irregular intervals of about a year, part 4 being the last. It is elaborately written and illustrated, and will form a valuable book of reference.

There are several small and cheap books on *British Shells*, but some of them are inaccurate or out of touch with the present knowledge of the subject.

The works on the European Mollusc fauna to be consulted are:—

Carl Agardh Westerlund's *Fauna der in der Palaarctischen Region, Lebenden Binnenconcylien*, published in 1886. This is the standard work, and costs about £3 7s. 6d. It is written in the German language.

Emil Adolf Rossmaessler's *Iconograhphie der Land- und Süsswasser Mollusken*. Vols. 1-18, first issued in 1835, is still being published in German, at about 27s. a volume.

British Dragonflies. 40 Coloured plates. By W. J. Lucas. *Price to subscribers, 21s.* Prospectuses ready. In the Press.

Cries and Call Notes of Wild Birds. A popular description of the notes employed by our commoner British birds in their songs and calls. Illustrated by musical notation. By C. A. Witchell. *In paper, price 1s., by post 1s. 2d.*

Naturalist's Directory for 1889 (Fifth year of issue). Invaluable to all Students and Collectors. *In paper, price 1s., by post 1s. 3d.*

Practical Taxidermy. A Manual of Instruction to the Amateur in Collecting, Preserving and Setting-up Natural History Specimens of all kinds. With Examples and Working Diagrams. By Montague Browne, F.Z.S., Curator of Leicester Museum. Second Edition. *In cloth gilt, price 7s. 6d., by post 7s. 10d.*

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For the French species consult, though the nomenclature is old, HORACE BENEDICT ALFRED MOQUIN-TANDON'S *Histoire Naturelle des Mollusques de France*. 2 vols., with 54 plates, published 1855. Cost, about 38s. with plain, and 62s. with coloured plates.

DOMINIQUE DUPUY'S *Histoire Naturelle des Mollusques terrestres et d'eau douce qui Vivant en France*, with lithographic plates by M. J. Delarue, 1847-52, about £1 7s. 6d. second-hand.

For classification of shells generally, SAMUEL PECKWORTH WOODWARD'S *Manual of the Mollusca*, (Recent and Fossil Shells), with Appendix by R. TATE, 4th edition, 23 plates, 1890, is the best at low price. It costs 7s. 6d. The great works by FISCHER, TRYON and FERUSSAC are founded on this Manual. Fischer superseded Woodward, and Tryon and Pilsbry have again superseded Fischer.

In French, is PAUL FISCHER'S *Manuel de Conchyliologie*, recent and fossil, with the Brachiopods, by D. P. CEHLERT, published in 1887, with 23 plates of 600 figures.

FERUSSAC AND DESHAYES' *Histoire Naturelle de Mollusc*, 2 vols. and 247 plates, 1829-1857, published at about £24 plain plates, and £50 with coloured, obtainable second-hand at £13 10s. and £24 respectively.

The most modern general work on shells was founded by the late GEORGE WASHINGTON TRYON under the title of a *Manual of Conchology*. It is still in process of publication, being continued by HENRY A. PILSBRY. The first series includes the Marine Gastropods in 14 volumes. The second series has 8 volumes completed, which deal with the Pulmonata; with a special monograph of the great family Helicidae. It is issued in parts, with 16 to 24 plates in each, by the Academy of Sciences o Philadelphia. Each volume consists of four parts. Price $3 per part, with plain plates, and $5 coloured.

For the general natural history, classification and other subjects connected with Mollusca, the most recent work of importance in English, is vol. 3 of the *Cambridge Natural History* series. It is by A. H. COOKE, A. C. SHIPLEY, and F. R. C. READ, published in 1896, price 17s. net. This is one of the first books which should be obtained by the beginner on Mollusca.

Reference should be made to the back volumes of the *Zoological Record*, and also to that work as it appears, for the latest information about mollusca, especially with regard to classification. The *Zoological Record* is published by the Zoological Society of London, the price being £1 10s. per annual volume. Early volumes can be had for about 10s. 6d.

There are three English Magazines that devote space to the Mollusca. They are the *Journal of Conchology*, the *Journal of Malacology*, both issued quarterly, at 6s. per annum, and SCIENCE-GOSSIP, monthly, Sixpence.

A HISTORY OF CHALK.

BY EDWARD A. MARTIN, F.G.S.

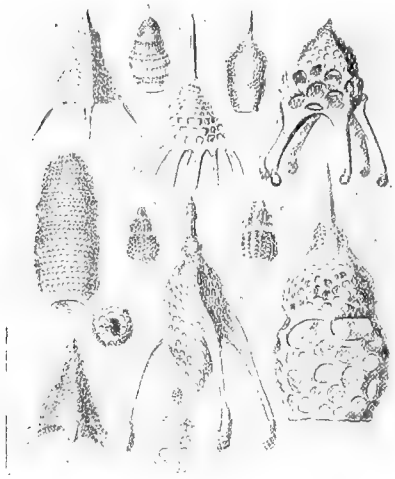
(Continued from page 14.)

SPECIMENS of Chalk taken from deep borings have been microscopically examined, and from these, interesting results have been obtained. At Culford, in Suffolk, Chalk brought from a depth of 636ft., was found to contain foraminifers amongst shell-dust, which seemed to form the matrix. In this case most of them were identified by Dr. G. J. Hinde as Textulariae. At Ware, in Hertfordshire, a piece of soft white Chalk was brought up from a depth of about 149ft., and this was found by Mr. W. Hill to contain also many minute Textulariae, whilst a fragment from a depth of 387ft. contained various *Globigerina*, which was the most common genus represented. It is always the same. Wherever a piece of Chalk is microscopically examined, remains of *Foraminifera* are found, whether it be newly hewn from the chalk-pit, or brought up by the boring-tool from some deep bore-hole.

It was formerly very widely thought that the foraminifers which make up the greater part, not only of the Chalk, but also of other geological formations, lived at the bottom of an ocean. This erroneous impression was, however, dispelled by discoveries which were made by the well-known "Challenger" expedition. It was found that these rhizopods lived in countless numbers at the surface of the sea, especially in the warmer waters of the tropics, and the North Atlantic. They sink from the surface, after death, perhaps through a mile, two miles, or nearly three miles of water, as a perpetual "drizzle," becoming deposited upon the bottom of the ocean in the form of conglomerated chalky mud.

The "Challenger" expedition was fruitful in its results, especially in so far as it enabled geologists to realise how strata were deposited—grew, so to speak, at these remote depths. It will be as well here to give a short account of some of the facts brought to light which touch specially the subject we now have under consideration. The expedition was equipped by the British Government with the intentions as stated by Mr. John Murray, F.R.S.E., a member of the scientific staff, which accompanied the vessel. They were:—"To determine, whenever possible, the depth of the ocean. To ascertain the nature of the deposits taking place over the floor of the ocean. To procure specimens of sea water from various levels from the surface to the bottom, and

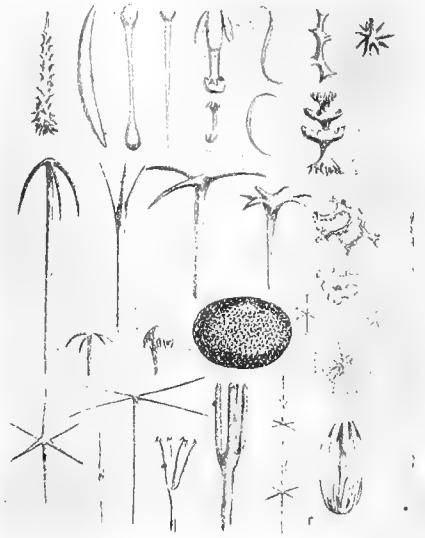
to examine these chemically and physically. To ascertain the temperature of the ocean at various depths from surface to bottom. To catch, examine, and bring home the creatures that live in the surface and deep waters of the ocean and on the bed of the sea itself. To measure ocean currents. To take magnetical and meteorological observations daily. In short, to carry on whatever researches might throw light on the physical, chemical, and biological conditions of the deep sea, and, in addition, to examine the plants, animals, and geological structure of all oceanic islands, and other little-frequented lands visited by the ship."



RADIOLARIA.

The "Challenger" left Sheerness in December, 1872, and arrived home in May, 1876, after passing round the world by an indirect and sinuous route. The voyage covered some 69,000 miles of ocean, in which over 400 deep-sea soundings were taken. One of the most important results of its investigations has been to demonstrate that the bottom of our modern ocean, far from being the abode of death, is peopled by many extraordinary forms of life. Also that where the depth can be measured by miles, we have a teeming population of the humbler forms. All the great types among the invertebrata have been found at depths beyond three miles. These include echinoderms (sea-urchins, brittle-stars, sea-cucumbers), brachiopods, annelids, sea-spiders, barnacles, shrimps, and a few corals; whilst amongst the vertebrata, fishes have been dredged of curious and interesting forms. These were found, both in the living state and also in a skeletonised condition, where they possessed a hard skeleton. The most interesting portion to geologists of the discoveries was undoubtedly the satisfactory determination of the nature of the deposits forming on the ocean's bed, and which in many cases formed the imbedding matrix for the remains of the higher forms of creatures just mentioned. These deposits, "oozes," as they are called, were found, by both chemical and microscopical examination, to bear a close resemblance to those substances which are familiarly known to us as Chalk. Indeed, a prominent member of the "Challenger" expedition announced, whilst the novel results found were scarcely thoroughly examined, that we were still living in the cretaceous epoch. This statement is, however, now completely scouted by scientific men; but it was perfectly excusable in the early excitement aroused. Deposits were found, some consisting principally of microscopic calcareous (chalky) foraminifera or pteropoda, others principally composed of silicious (flinty) microscopic organisms belonging to the order Radiolaria, or to the vegetable Diatomaceae. These oozes are pelagic, that is, occur far from land.

It is estimated that for about 200 miles out at sea, all around our continental coasts, the bottom of the sea is covered by what have been classed as Shore Deposits. These result from the gradual denudation of the land, and consist of great accumulations of river and coast detritus. The clay or mud brought down by rivers is carried far out to sea in



SPONGE SPICULES.

a state of fine sub-division. It is deposited beyond the influence of tides and currents. Sand similarly carried down by the rivers to the sea, in a state of suspension, is by reason of its heavier nature, deposited within this 200-mile limit earlier than the clay, so that in this area we have sedimentary rocks forming. These will constitute the clays, the chalks, and the sands as true geological formations in ages to come.

Beyond this limit, we arrive at a point out of reach of the influences of rivers and tides, and different conditions prevail. Roughly speaking, after we pass beyond this imaginary boundary, and reach those parts where the depth of the ocean varies from one to two and half miles, we come, both in temperate and tropical regions, to those areas where the great calcareous

deposits are forming. These have received the name of Oozes. According to the predominating constituent, these oozes are known as Globigerina Ooze or Pteropod Ooze. It is but fair to say that all the deposits, whether the most prominent type of organism be the one or the other, also contain in varying proportions either other *Foraminifera*, molluscs, or calcareous *algæ* (seaweeds). In some places, the ooze assumes a different character. In the Antarctic Ocean, and in other areas where there is a relatively low specific gravity, the deposit was found to consist chiefly of the microscopic frustules of diatoms. As these vegetable organisms are chemically of a silicious nature, we have here what is known as a Silicious Ooze. This, we may imagine, was in cretaceous times a partial source of the silica, afterwards deposited as flint. Nor was this the only silicious ooze. Another order, belonging to the class Rhizopoda, to which it will be remembered the Foraminifera belong, is the Radiolaria. Representatives of this order were so numerous in an area in the Middle and Western Pacific that they constituted a Radiolarian Ooze. The Radiolaria bear a close resemblance to the Foraminifera, but differ from them in the fact that their little globules of olive-brown sarcode are enclosed in beautiful glassy tests composed of silica, instead of carbonate of lime, and these are often most delicately sculptured and chased. Here, then, we also have an ooze of a silicious nature. *Haliomma*, a member of the radiolarian order of the Polycystinae, was a common form found in the ooze. It possessed a spherical test or shell, with numerous holes through which the pseudopodia were emitted, and the test was often adorned with spines. A newly-discovered family has received the name of Challengeridae, most of its members possessing purse-shaped silicious shells, with one or more openings, and frequently being ornamented with pit-like markings.

The deep-sea oozes are as follows :—

(i.) Calcareous : (*a*) Globigerina Ooze ; (*b*) Pteropod Ooze.

(ii.) Silicious : (*a*) Diatom Ooze ; (*b*) Radiolarian Ooze.

(*To be continued.*)

SUBSPONTANEOUS MOSSES.

By J. A. Wheldon.

AMONGST the accepted natural integers of the flora of any given district, we constantly meet with strangers which have become accidentally mingled with the true natives. These, according to their permanence and mode of introduction are variously classed as aliens, casuals, denizens, or colonists. In most of our local floras the status of our flowering plants is carefully worked out, but amongst the smaller cryptogams it is very seldom that any attempt is made to determine whether the species are native or otherwise. These more obscure plants are usually accepted as aboriginal inhabitants, and probably rightly so in the majority of instances.

It is, however, certain that introductions must constantly occur, although it is seldom easy to prove that they are importations. The common species are continually reinforced by immigrants, which probably arrive as spores in soil, conveyed in various ways by man and other animals, or by the wind. The growing plants themselves may also be brought in with earth at the roots of introduced trees and plants, or may be transported on stones and tree trunks from place to place by human agency or floods.

Perhaps immigrants received by some of these methods should hardly be considered as casuals, the means of introduction being quite natural. To take an example, *Cinclidotus fontinaloides* can hardly be classed under any category except that of native, when it occurs sporadically in the lower reaches of the river Ouse about York. Yet it is obviously not at home, and only maintains a precarious existence there. Its occurrence is no doubt brought about accidentally by floods and violent spates of the Yore and Swale, in the upper reaches of which it thrives exceedingly. An exactly analagous case may be quoted from the phanerogamia. *Rumex aquaticus* is brought down by floods to Clifton Ings, in the same manner, where it establishes itself for a time, but if not reinforced would probably soon disappear from the banks of the Ouse.

The occurrence of *Pottia heimii* in the grounds of St. Mary's Abbey, at York, was perhaps quite as accidental a circumstance as that of *Fissidens crrii* in the vicinity of the Glasnevin Botanical Gardens. The same, I have but little doubt, would apply to *Bryum murale* in many of its recorded stations. In my own somewhat limited experience of this rare moss, it usually affects the mortar of walls, and is very apt to disappear in a short time ; so that in localities where it is fairly plentiful one year it may not be found at all the next. When so situated I look upon it as a mere casual, notwithstanding that the specific name is bestowed on account of its apparent predilection for such habitats. In the Mersey Province, its only natural home is on the limestone scars of West Lancashire, where this moss abounds in rock crevices about Silverdale, Yealand, and Carnforth. Elsewhere in the Province named, it occurs only on walls, in isolated localities, as at Fleetwood, Marple and Bromboro. Mr. Bagnall notes it, again on walls, from a single locality in Staffordshire. Can any reader of Science-Gossip give another instance of the occurrence of this species on rocks ?

I believe *Leptobryum pyriforme* is truly at home on the sand dunes of the Mersey Province, and in the limestone districts of Yorkshire and Derbyshire, but I am more sceptical as to many of the other stations which are recorded. It is somewhat astonishing to see the regularity with which this moss springs up in greenhouses and garden frames. It is evidently brought, often from long distances, with soil about the roots of plants, and in these situations has no more right to be classed as an integral part of the flora, than the stove plants with which it is introduced. *Lunularia vulgaris* has a similar predilection for living under glass, as also have *Funaria hygrometrica* and *Pottia truncatula*.

Mosses found on felled timber brought from a distance are open to suspicion, even when the trunks have lain long. *Tortula papillosa*, otherwise unknown in South Lancashire, and very rare in West Lancashire, was found by Mr. Whitehead in such a situation at Ashton-under-Lyne. He ascertained that the tree trunks had been sent from Welshpool, hence the moss cannot be admitted in the South Lancashire vice-comital list. Foreign mosses are often imported on timber, and I have seen fine fruiting specimens of exotic genera, not represented in the British flora, on tree bark in the Mersey dockyards. It does not appear likely that any of these will naturalize themselves in this country, although, given suitability of climate it is easy to imagine the introduction of new species by this method.

H.M. Prison, Walton, Liverpool.

BRITISH FRESHWATER MITES.

By CHARLES D. SOAR, F.R.M.S.

GENUS *TEUTONIA* KOENIKE, 1890.

(*Continued from page* 20.)

THIS genus, at the time of writing, contains only one species, which is very closely allied to those of *Limnesia*. Its characteristics are also the same as *Limnesia*, with the exception that the three discs on each side of the genital plate are on the inner margin; whereas in *Limnesia* they are on the outer.

Teutonia primaria Koenike, 1890.

FEMALE.—Body: Oval in form. Length about 1·04 mm. Width about 0·96 mm. Colour yellow with brown markings on dorsal and ventral surface.

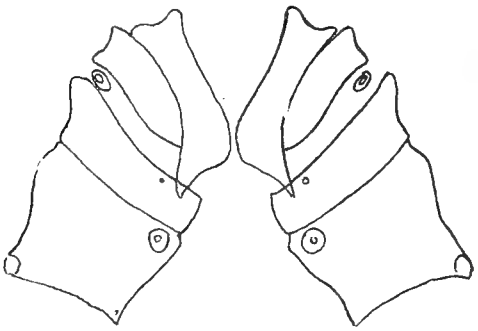


Fig. 1.—*T. primaria*. EPIMERA OF FEMALE.

LEGS.—First pair about 0·92 mm. Each pair gradually gets longer, the fourth pair being about 1·20 mm. The first and second pair of legs are very sparingly supplied with hairs, but the third and fourth pairs have a large number. All the legs gradually taper from the epimera to the ungues. The tarsi of the fourth pair of legs are brought to a point in the same manner as the corresponding segments in the species of *Limnesia*. Colour of legs yellow.

EPIMERA.—(Fig. 1.) Arranged in four pairs but of quite a different shape to those of *Limnesia*, the posterior plates being more square. Colour yellow, like all the parts of this mite.

PALPI.—(Fig. 2.) Large and long, being about 0·56 mm. in length. The fourth segment is long and slender, with small hairs all along the lower edge.

GENITAL AREA.—(Fig. 3.) The plates of this mite differ very much from *Limnesia*. The discs are on the inner edge, and these are covered with a chitinous flap, which is sometimes partly open, as seen in fig. 3.

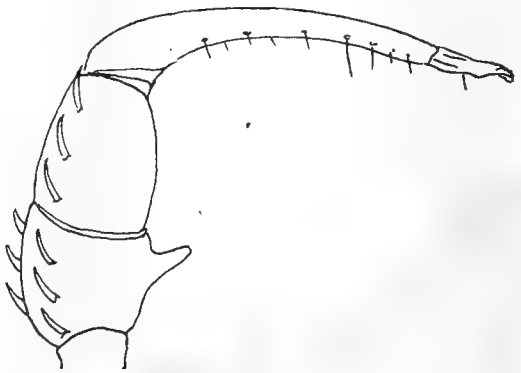


Fig. 2.—*T. primaria*. PALPUS OF FEMALE.

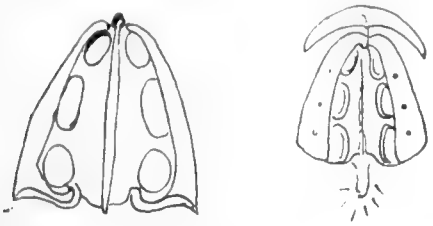
MALE.—The males are a little smaller than the females. The genital plates (fig. 4) differ slightly from those of the female. It has not the crescent shape piece above the plates which may be observed on the female.

LOCALITIES.—I have at present only found this mite in two places—Bealings, Suffolk, in 1895, and in North Wales in 1896.

Genus Lebertia Neuman, 1879.

This is another genus at present containing only

one species, but there are two if not three varieties of this species, which I describe.



Figs. 3 & 4.—*T. primaria*. Genital plates of female and male.

This genus is characterised as follows: Body nearly circular. Epimera forming one group, skin soft. The genital discs on the inner edge of the plates, three on each side, similar to those in *Teutonia*. Eyes wide apart. Swimming hairs to all legs. Palpus not chelate. Claws to all feet.

Lebertia tauinsignita Lebert, 1879.

Female.—Body: A round oval. Length about 1·25 mm. Width about 1·04 mm. Colour: First variety, a brownish yellow, with a T-shaped yellow mark of a lighter colour, on the dorsal surface.

Fig. 5.—*L. tauinsignita*. Ventral surface of female.

Variety 2. All green with a lighter tinted T-shaped piece in the same position as in variety 1. Variety 3 has not yet been found in Britain. It is figured by Neuman as a bright red mite. The mite figured by Piersig is the same as our first variety.

Legs.—First pair about 0·60 mm. Fourth pair about 1·08 mm. Colour same as body. All legs have hairs, the fourth pair having the longest. All the feet have small claws, as shown in fig. 5.

Epimera.—(Fig. 5.) Are arranged in one group, quite differently from the genera *Curvipes* or *Limnesia*. The surface is all finely granulated, as is also the chitinous parts of this mite.

Palpi.—(Fig. 6.) About 0·32 mm. in length. The peg is not so conspicuous in *Limnesia*, but it has a strong bristle in its place. The fourth segment is also shorter and thicker than the corresponding segment on many other mites.

Genital Area.—This part of the external anatomy is very much like the genital area of *Teutonia primaria*, having the three discs on the inner edge of the plates. These are sometimes covered over with a small chitinous flap.

Male. This sex is rather smaller than the female, but does not show sufficient difference in structure to require a figure.

Fig. 6. Palpus of female.

L. tauinsignita.
Fig. 8. Genital area of Nymph.

Nymph.—(Fig. 7.) The nymphs are very much like the adults, except in the genital arrangement, the discs numbering four, instead of six, as seen in fig. 8. Its length is about 0·68 mm.

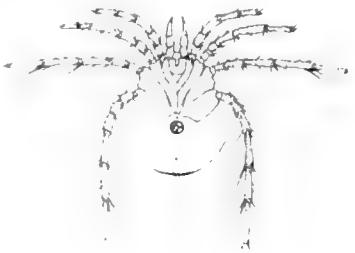


Fig. 7.—*L. tauinsignita*. Ventral surface of Nymph.

Localities.—Not common. I found the green variety in 1895 at Bealings, Suffolk. Mr. Scourfield found the No. 1 variety in 1898 at Grasmere; and Mr. Taverner discovered the same coloured mite in 1898 at Oban.

(To be continued.)

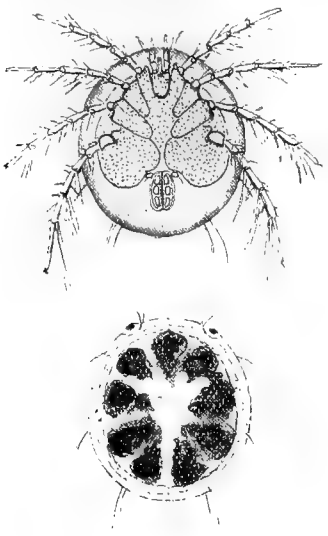
MIDEOPSIS ORBICULARIS OF MÜLLER.

By C. F. George, M.R.C.S.

THIS very remarkable and interesting little fresh-water mite was first figured and described by Muller 1776-1781, under the name of *Hydrachna orbicularis*. It was then apparently overlooked until 1879, when Neuman described and figured it under the name of *Mideopsis depressa*, a more descriptive name than that of Müller; for though the mite is almost circular in figure, the upper surface is not at all convex, but flattened and even irregularly depressed, so that the edges are higher than the centre. This gives the mite, when alive and moving on the surface of the mud, a most singular appearance.

Female.—Body: In colour *M. orbicularis* is generally of a rather dirty yellow, with dark caeca. Its appearance varies considerably with the contents of the caeca. A depressed circular line runs all round, very near to the outer edge. The black eyes, one on either side, project beyond the edge of the body and are therefore very conspicuous. In the centre the Y-shaped caecum is filled with opaque intensely white

material, and sometimes the very delicate red and blue colour of the dorsal shield can be seen. If the dorsal plate be dissected from the dead mite, cleaned and mounted in Canada balsam, it makes a very beautiful object for the microscope, the finely granulated texture with the delicate colouring of transparent red



Mideopsis orbicularis MÜLLER.

and blue, reminding one of those circular diatoms, which from their thinness, decompose the light.

LEGS.—These are pretty equal in thickness, and length; all of them are provided with claws, and swimming hairs, which are more numerous on the three last pairs.

PALPI.—The palpi are short, and pretty stout, the last joint is claw-shaped, not simple, but does not make a forceps, as in the Arrenuri. The thigh plates are of a delicate blue colour, and coalesce, so as to form a sort of shield, over the central portion of the abdomen; and a well-marked sort of bay is formed posteriorly, between them, by their projection on either side. The skin is chitinous, and very finely perforated, tougher and not so brittle as in *Arrenurus*. The thigh plates are more highly chitinized than the skin, the perforations are larger, their colour is intensified by mounting in balsam.

GENITAL PLATES.—In the centre of the bay, formed by the two posterior thigh plates, are the two remarkable genital plates; each plate having three genital discs on the outer side, placed in a line, the one behind the other; as is well seen in Mr. Soar's accompanying characteristic figure.

THE MALE differs very little from the female. It is somewhat smaller, and a little nipple-like projection, in the centre of the posterior edge of the body, is usually conspicuous.

THE LARVA is very small, and circular. I have not been able to make out, whether the larva is parasitic; and if so, I have no idea what creature forms the host.

THE NYMPH, though larger than the larva, is small in comparison with the adult; and has two genital discs on each side.

LOCALITIES.—This mite is not rare, though I have not found it very abundant. It occurs with Arrenuri and is easily identified by its circular figure, and rather slow movements when crawling on the sides of the vessel in captivity.

I do not know of any other species of this genus.

Piersig gives very beautiful figures of the larva and nymph, but more highly coloured than the specimens with which I have met. I first figured this interesting freshwater mite in my note book in May, 1881.

Kirton in Lindsey,
Lincolnshire, May, 1899.

DOUBLE CANALS IN MARS.

MR. FRANK DENNETT, writing in your Astronomical Columns (Vol. v., page 283), attributes the peculiar phenomenon of the visibility of double canals in Mars to the imperfect focussing of the telescope. This appearance has been the subject of a good deal of controversy since the time of its so-called discovery by Schiaparelli, with his 8½ inch telescope at Milan in 1877. That this double appearance of canals is not due to imperfect focussing of the telescope, as stated by Mr. Dennett, can be determined by the fact that almost all observers of the planet Mars have noted this phenomenon, and if it were really caused by bad focussing, the canals on the entire disc would appear double at one and the same time; whereas certain canals have appeared double and others single in one night, and on another night this order of things has been reversed. As one of the causes, for it is my object to point out several, for this appearance, I must mention that the rotation of the planet on the one hand and that of the Earth on the other, must be taken into consideration. Further, it is a well-known coincidence that persons affected with astigmatism, always see objects duplicated with the defective eye when viewing objects from a certain angle, and it might also be partly to this condition that Martian gemination is attributable. The planet is closely surrounded by clouds and vapours and this marvellous duplication may also result from the amount of refractive aberration due to the surrounding density of the atmosphere. One important fact connected with this duplication, and why all the canals are not seen double at one and the same time, should be sought for in the presence of a direction in which the geminating phenomena attain their maximum intensity, at right angles to which there is no doubling. Antoniadi attributes it chiefly to a temporary inability of the eye to define linear markings well nigh at the limit of visibility, and does not wholly put it down to astigmatism. That the density of the atmosphere in places of observation of comparatively low altitudes is undoubtedly one of the causes of this duplication, is patent from the fact that the planet when viewed through the great Lick telescope in the pure

atmosphere of Mount Hamilton, U.S.A., does not exhibit the "canals" at all, and this has been confirmed by one of the most skilful of planetary observers.

W. Robertson, V.S., G.B.V.C., M.B.V.A.

Madras, India,

16th May, 1899.

I have been very much interested in reading Mr. Robertson's communication. He and I are really in very close agreement. The instrument may be accurately focussed, but very soon the eye wearies slightly, and its focus changes imperceptibly. If any astigmatism be present, duplicity just becomes visible in the direction of this weakness. With regard to the failure of the Lick instrument, it was perhaps to be expected. Dawes, long ago, pointed out that beyond certain limits, aperture did not help the detection of planetary detail. The experience, also, of the Mars section of the British Astronomical Association, is, that the best work has been accomplished by telescopes of between 9 and 10 inches' aperture. The suggestion as to a possible action of the Martian atmosphere, may, I think, be abandoned. —*Frank C. Dennett.*

VISITATION DAY AT GREENWICH.

SATURDAY, June 3rd, was a splendid summer's day, and a goodly company besides the official visitors gathered at the Royal Observatory, Greenwich, amongst others of importance being the veteran Professor Simon Newcomb, Mr. S. P. Langley of the Smithsonian Institution, and Prof. Cornu. All the instruments were open for inspection; the Sheepshanks 6¾in. equatorial was alone turned to the heavens. Owing to the state of the atmosphere, the sun was the only object which could be observed. He exhibited a solitary spot surrounded by faculae, and two other groups of faculae in its vicinity, a little within the eastern limb.

The building containing the Thompson equatorial, was completed last March by the addition of the east and west wings. The erection is now cruciform in shape, having the central Observatory tower, and four wings of three stories. These are for the accommodation of the staff, the library, the photographic and other records, the Observatory publications, and a workshop.

The new magnetic pavilion, about 350 yards east from the Observatory, but within the park, was completed at the end of September last, and the standard thermometers and rain-gauges have also been mounted within its enclosure. About the same time the balcony was completed around the building containing the 28in. telescope, and has proved of great service. The electric light installation necessitates the use of accumulators, and a new house for their storage was completed in March last, but they have not yet been installed.

What was formerly the Astronomer Royal's Official Room, has now been made an additional chronometer room, and will accommodate 140 chronometers. Between May 11th, 1898, and May 10th, 1899, no less than 11,764 transits of about 5,000 celestial objects have been observed with the Transit circle.

The New Alt-azimuth has needed several alterations, and was not considered completely satisfactory until February 23rd last. A chronograph is being constructed by Sir Howard Grubb for use with this instrument. The Thompson equatorial seems to be now quite satisfactory; the refiguring of the outer surface of the 26in. object glass having been completed on June 8th, 1898, and it was finally approved, after a thorough testing, in the following September. The 30in. Cassegrain reflector at the other end of the Declination axis, has had a new mirror of slightly shorter focus ground for it, by Dr. A. A. Common. This was received in September last, and has proved quite satisfactory. This instrument was found to have a trick of running too fast, when west of the meridian; a fault due to too much weight on the refractor end of the axis: a weight of 15lb. running over a pulley, since January 10th, has remedied this defect. It has been employed in photographing Neptune and its satellite, some double stars, and a few fields of stars. The reflector has been used in obtaining photographs of the new planet Eros, Neptune and its moon, the comets of Brooks and Tuttle, the Pleiades, the nebula in Andromeda, and the moon. The 28in. refractor has been used for the micrometric measurement of 410 double stars, the majority having their components separated by less than one second. With the 13in. Astrographic equatorial photographic plates have been taken on 120 nights; but for various reasons, seventy-eight have had to be rejected. To complete the sets only 241 successful photographs remain to be taken. When the whole is completed, the damaged plates, mentioned last year, will be replaced.

Photographs of the sun have been secured on 195 days, before July 27th with the 4in. Dallmeyer, and, since that date, with the 9in. photo-heliograph attached to the Thompson equatorial. The photographs from India and Mauritius bring up the total days to 357; and some further plates are expected from the latter place, which may yet complete the series. The photographs of the magnetic disturbance on September 9th last were remarkable.

The mean declination of the magnetic needle for 1898 was 16° 39.2′ West; and the dip from January to June 67° 1.4′, and from October to December 67° 11.3′.

The mean temperature of 1898 was 51.3°, or 1.8° above the average of the fifty years 1841-90. The highest daily temperature, 92.1°, was on September 8th. Only once before has such a temperature been recorded in September, on the 7th of that month in 1868. During the year ending April 30th, 1899, 1,500 hours of bright sunshine were recorded out of a possible 4,454. The entire visitation was very interesting.

FRANK C. DENNETT

TICKS AND "LOUPING-ILL."

By E. G. Wheler.

(Continued from page 7.)

THE commencement this year of the attack of the ticks on the sheep, occurred about March 1st, on which day two female ticks were found on a sheep at Gowanburn Farm, in the occupation of Mr. Dagg, in the North Tyne Valley. Professor Somerville, of the Durham College of Science, Newcastle-upon-Tyne, has commenced some experiments on the sheep at this farm, and has received not only valuable information, but also very material assistance from Mr. Dagg. On April 19th, a number of adult ticks were present on the sheep, consisting of young as well as distended females, and some males. A distended pupa was also found on the face of one of the sheep.

These creatures are locally known as "face ticks," being usually found on the sheep's faces. They were supposed to be a different species of tick, but there is no doubt that they are the pupae of *I. reduvius*. They were subsequently found in considerable numbers, distended and undistended, together with larvae in both conditions, on some sheep in Alnwick Deer Park. These latter sheep had only been turned on to tick-infected land three weeks previously, and it was noticed that no fully matured females were found upon them, though partially distended ones, were fairly numerous.

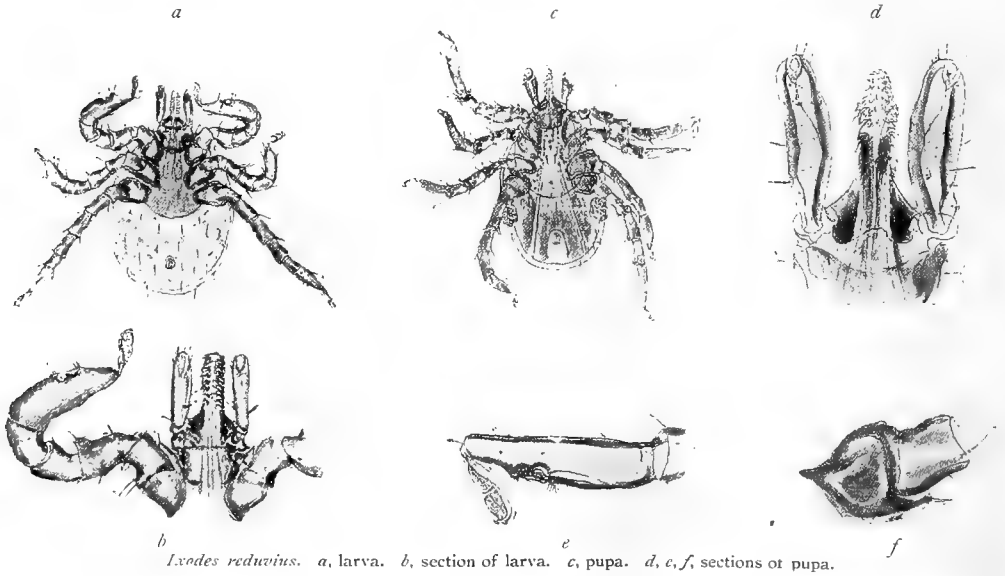
On June 2nd the attack was found to be nearly over. Some sheep on the farm were then affected with louping-ill, which curiously had become prevalent during the recent fine warm weather; whilst the district had been almost free from it during the previous exceptionally wet cold weather of the previous month. This was quite contrary to the experience of other years and no reason for it could be suggested.

Some of the females commenced to lay eggs on the 12th of May. All the ticks found on the sheep were, without exception, *Ixodes reduvius*. There seems little doubt this species only, attacks sheep in this district. Only a few isolated specimens were found on the collie dogs. These, however, suffer from the attacks of a different species. The dogs are never known to have louping-ill.

The size of individual ticks varies, and of course so soon as distension commences in any stage, it rapidly increases. For both these causes of variation, full allowance must be made—as well as for the variation of colour at different stages of distension, which has been already alluded to.

It is hoped that the following descriptions may suffice to identify the species in all its stages.

Ixodes reduvius Linnaeus = *I. ricinus* Latreille.



Ixodes reduvius. *a*, larva. *b*, section of larva. *c*, pupa. *d*, *e*, *f*, sections of pupa.

This species is found on sheep, deer, and occasionally on dogs.

Adult Female.—Length about 3·25 mm. to 10 mm. by 3·40 mm. wide, by 5 mm. deep, when fully distended. Shield and spiracles large. Legs and palpi long. Rostrum long, with thirteen barbs on each lateral margin, and corona, (1) chelifers with six hooks. Coxae of first pair of legs long, triangular, and furnished with a long spine. Legs, shield, rostrum, etc., dark brown to nearly black. Colour of body deep orange red, showing four indistinct intestinal lines, lighter underneath. Light grey in front both above and beneath. Pubescent, opaque and widely margined. (Fig. 6, and mounted in balsam fig. 7). When distended the colour is very variable. Light red to reddish grey, or even almost pure white. When fully distended olive-green, or dark lead colour to

(1) By "corona" is meant the two or three rings of embryo barbs at the end of the rostra of females, too minute to be considered as barbs.

black. When about to lay eggs, with yellow or grey irregular lines or markings on the back and sides. One large yellow spot underneath. (Fig. 8.)

The following are the proportionate measurements of various parts of the adult female, including the joints of each leg. Unit adopted 50 1 mm. or 12 one hundredth of an inch approximately.

Length 164	Rostrum 28	Palpi 36	Spiracles 20	Shield 73					
Breadth 88	,, 8	,, 12	,, 16	,, 64					
Legs (1st)	....	L	28a	16	28	24	22	40	
		B	16	10	10	10	9	8	
(2nd)	....	L	24	16	40	20	16	26	
		B	14	12	10	10	9	8	
(3rd)	....	L	28	16	24	22	20	28	
		B	16	12	9	9	8	7	
(4th)	....	L	26	22	36	28	24	32	
		B	16	10	9	9	8	6	

(a Includes 8 for length of spine.)

ADULT MALE.—Length about 2·57 to 2·80 mm. Coxae of anterior legs furnished with a shorter spine than the female. Palpi and rostrum much shorter and wider than in the female. Rostrum has six barbs, chelifers five hooks. Body dark brown, almost black, with light brownish white margin. Mottled with very obscure deep reddish irregular markings

FIG. 6.

FIG. 7.

FIG. 8.

Ixodes reduvius.

Fig. 6 female. Fig. 7 female in Balsam. Fig. 8 female distended with ova.

that are difficult to see, even when magnified (fig. 9; the same in balsam, fig. 10).

Length 140	Rostrum 12	Palpi 18	Spiracles 16	Shield 108					
Breadth 80	,, 8	,, 8	,, 10	,, 58					
Legs (1st)	....	L	16a	10	18	16	14	28	
		B	12	8	10	10	10	8	
(2nd)	....	L	16	10	12	12	10	18	
		B	12	8	8	8	8	6	
(3rd)	....	L	16	12	16	14	12	20	
		B	14	10	8	8	8	6	
(4th)	....	L	18	16	24	20	16	24	
		B	14	8	8	8	8	6	

(a includes 4 for length of spine).

LARVA.—Length 0·80 mm. undistended, to 1·43 mm. distended. Rostrum with ten barbs, chelifers with four hooks. Body more transparent, marks very similar but fainter, and olive-green. Legs, rostrum, etc., testaceous. (Fig. 11.)

Length 40	Rostrum 6	Palpi 8	Shield 16						
Breadth 24	,, 4	,, 4	,, 18						
Legs (1st)	....	L	4	4	6	5	4	11	
		B	3	3	3	3	3	3	
(2nd)	....	L	6	4	4	4	4	8	
		B	4	3	2	3	3	3	
(3rd)	....	L	6	4	5	5	4	8	
		B	5	3	2	2	2	4	

FIG. 9.

FIG. 10.

FIG. 11.

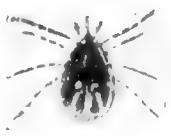


FIG. 12.

Ixodes reduvius.

Fig. 2 adult female. Fig. 10 male in Balsam. Fig. 11 Larva. FIG. 12 Pupa

PUPA.—Length 1·50 to 1·68 mm. undistended, to 3·30 when distended. Rostrum 12 to 14 barbs, chelifers five hooks. Body olive white, transparent,

FIG. 13.

Ixodes reduvius. Female and Eggs.

with four distinct brown posterior intestinal marks. Also similar anterior marks leaving a paler centre to the shield, which is shaped like an arrow head. When distended the body is of a uniform black. Legs, rostrum, etc., testaceous or brown. (Fig. 12.)

Length 76	Rostrum 12	Palpi 16	Spiracles 8	Shield 32					
Breadth 42	,, 4	,, 4	,, 7	,, 28					
Legs (1st)	....	L	10	6	10	10	8	20	
		B	8	6	6	6	6	5	
(2nd)	....	L	8	7	8	8	7	12	
		B	6	5	4	4	4	3	
(3rd)	....	L	12	8	10	9	8	12	
		B	8	6	5	5	4	4	
(4th)	....	L	10	10	12	12	10	16	
		B	8	6	5	5	5	4	

After attachment to the host both the larva and pupa become replete with blood, black in colour, fully distended, and with the exception of size, closely resemble the fully distended female in general appearance. It is to be noticed that the size of the

fully distended larva approximates very nearly to that of the undistended pupa, and that in the case of the distended pupa, may actually exceed the undistended female in size. This is probably accounted for by the accidental individual variation of the specimens measured.

No growth is observable when ticks are kept in confinement on damp moss. It is probable therefore that length of body is only acquired by distension on the host by suction of blood. Other development, such as size of shield, rostrum, length and number of legs, are gradually formed after repletion, and after leaving the host. When these are complete the metamorphosis takes place, the tick then casts its skin and advances a stage in its existence, and at once seeks a fresh host.

Larvae hatched on August 4th last year, and kept in a bottle are still alive and active on June 7th, though no growth whatever is perceptible. For many weeks past the damp moss has been removed, and they have had nothing but damp sand and blotting paper, from which it would seem impossible for them to have derived any nutriment.

Fig. 13 gives a female and her eggs from a photograph.

(*To be continued.*)

FLOWERS ON OLD WOOD.

By Eleonora Armitage.

An interesting and suggestive letter was written by Dr. Augustus Henry from Yunnan, to Mr. Thistleton Dyer, which was published in "Nature," of November 17th, 1898. It contains the following sentences:—"In many of the Mengtze and Szemao trees and shrubs, the flowers occur on the branches below the leaves, and not on the peripheral surface of the tree, as in ordinary cases. Many lianas have this peculiarity. These are all forest plants, and I think the explanation is that in forests there are two surfaces open to insect visitors, the top of the forest and the bottom. Some trees and shrubs and climbers cannot get to the top, so they have their flowers at the bottom. But, of course, this explanation is only a guess." Dr. Henry goes on to mention as an example, *Mucuna sempervirens*, a liana interlaced among trees, nearly 200ft. by 100ft.: "The main trunk of the climber close to the ground was covered with flowers, which were easily visited by thousands of insects of all kinds."

It is desirable to have an explanation of the reason why the flowers of some tropical trees are thus borne on the old wood. It is one of the most striking peculiarities of tropical vegetation, and forces itself upon the observer, rather in the fruit than in the flower, the former being usually the more conspicuous. Such, at any rate, has been my own impression, when studying West Indian vegetation. The explanation suggested by Dr. Henry, though only as a guess, does not altogether commend itself to me.

It may be well to examine some other and familiar instances. A large forest tree, *Couroupita guianensis*, or "cannon-ball" tree, bears a succession of flowers around the lower part of the trunk, on peduncles of varying length. From these peduncles hang numerous fruits in different stages of growth. When mature they consist of large round woody capsules, from which the tree derives its vernacular name. If these fruits were borne on the distal portions of the branches, their weight would cause the branches to be bent down and distorted, and probably broken off.

Another case is that of *Theobroma cacao*, or cocoa tree, which is a rather low tree, much branched, and spreading. Its flowers are borne on peduncles an inch long, scattered on the trunk and larger branches. The oval fruits usually measure about seven or eight inches long, and eight or nine inches in circumference, and are borne in large numbers, ripening in succession. Their presence on the young twigs would be a source of danger to the latter.

Again, *Crescentia cujete*, or the calabash, is a tree of moderate dimensions, bearing its flowers on very short peduncles on the trunk and older branches. At the same season, fruits may be seen on the tree of varying sizes, from that of an acorn to the large, heavy, spherical fruits, some of which measure over twenty inches in circumference. It is unnecessary to indicate the result to a young branch if a fruit nearly the size of a football were hanging on it, when the trade-winds blow strongly.

Other examples might be adduced, but would take up too much space.

The suggestion, that the facts sketched above have more to do with the force of gravity than with insects, is put forward with diffidence, in the hope that it may call forth a real solution of the problem. It does not profess to clear up the whole question, as it only applies to the large-fruited examples, and not to others with a similar floral habit; for example, *Ficus*, where the fruit is not so large. It is not difficult to theorise on this subject, and to imagine a stage in the early history of one of these plants, when the flowers were borne normally on the young wood. A slight increase in the weight and dimensions of the fruit, if unaccompanied by a corresponding strengthening of the tissues of the branches, would lead to the snapping off of the latter. The plant would be compelled to develop dormant or adventitious buds on the older portions of the branches and stem, to replace those that had been destroyed. Such plants as were thus able successfully to resist the ravages of wind and rain might, after many generations, take on this habit and renounce their former one.

Something of the kind has already happened to some of the trees on the West Indian Islands, which were devastated by the hurricane of September, 1898. I heard in November that *Poinciana regia* and *Cassia fistula*, which were entirely stripped of their foliage and smaller branches, had put forth fresh leaves and even flowers, though normally their flowering season does not begin until May.

Dadnor, Herefordshire.
May 6th, 1899.

CINCHONA BARK.

By Lewis Ough, F.L.S., F.C.S.

THE genus *Cinchona*, from which this bark is obtained, constitutes with several allied genera, the tribe Cinchoneae of the natural order Rubiaceae. The tribe consists of trees and shrubs, with opposite leaves, two celled ovary capsular fruits and numerous minute ascending or vertical peltate, winged albuminous seeds. The genus has deciduous stipules the flowers in terminal panicles, a superior calyx with five teeth, the five lobed tubular corolla being fringed at the margin. The flowers are of a purplish rosy or white colour possessing a somewhat agreeable odour. The plants are evergreen, the finely-veined leaves being transversed with a strong midrib. There is a diversity of opinion as to the number of species known. Weddell, in 1870, enumerated thirty-three with eighteen sub-species, besides varieties and sub-varieties, whilst Bentham and Hooker estimate the species at about thirty-six, of which eighteen are known to yield commercial bark; the following four being the most important:—*Cinchona calisaya* Weddell, yielding Yellow Bark. *Cinchona officinalis* Linnaeus, the source of Loxa Crown or Pale Bark. *Cinchona succirubra* Pavon, giving Red Bark, by far the most important, and the variety principally used at the present time. *Cinchona lancifolia* Mutis, from which is derived Columbian or Coquetta Bark, but by some authorities this is treated as a variety of *Cinchona officinalis*. The Cinchona trees are all indigenous to the western part of South America, where they grow between 10deg. North latitude and 22deg. South latitude, an area which includes Bolivia, Venezuela, Ecuador, New Granada and Peru. They are found in the mountainous regions, the average altitude being about 6,000ft. above the sea level. The highest limit noticed is 11,000ft. One species, *Succirubra*, is however found as low as 2,000ft. The climate of this region is very variable, sunshine, mist, storms and showers alternating without much thermometric change. Some of the more hardy species may even for a short time be subjected to freezing-point without injurious results. Their growth appears to be influenced far more by climatic agencies than by the composition of the soil, for although the trees occur in a great variety of geological formations, these altered conditions do not, to any marked degree, control the development of the trees or their chemical constituents.

Previous to 1860 the Cinchona trees were only found wild in the above-named countries. Now they are carefully cultivated in India, Ceylon and Java, and these annually yield thousands of pounds of bark from which is obtained the bulk of the quinine and other alkaloids for use throughout the world. The word cinchona is not now merely a botanical term, but one which is in constant use by physicians, chemists, planters and merchants.

The genus *Cinchona* is so named after the fourth Countess of Chinchona, whose husband was in 1628 appointed Viceroy of Peru, which then included the whole of South America except Brazil. Previous to that time the bark was only known to the natives in one locality, where it was greatly distrusted by their itinerant doctors, and it may be said even now with some degree of truth that Peru is the only country where Peruvian bark is not extensively used. It first came into notice in 1638, when the Countess lay ill of tertian fever at Lima, and a parcel of the bark, then known as quinquina, was sent her by the corregidor of Loxa, which administered by her physician effected a complete and rapid cure. On her return to Spain two years later she brought back a quantity of the valuable bark for the use of the sick on her husband's estate, when the medicine was called Countess' Powder. The town of Chinchon is situate about twenty-five miles south-east of Madrid, and although the castle is now in ruins, the population is at present about 6,000 inhabitants. A few years later parcels of the powder were sent by Jesuits to Rome to be distributed. It was known there as Jesuit's Powder and Cardinal's Bark, with the absurd result that no Protestant would have anything to do with it for some time afterwards. At that time its value was about 100 raels per pound. It was not until 1735 that the forests of Loxa were visited by French scientific men, and a few years afterwards specimens were sent to Linnaeus, who described it and very appropriately named the genus in honour of the lady who first made its healing virtues known. Unfortunately, he was misinformed as to her name and the "h" was omitted, most probably in consequence of having received it through a French source. In some of his later editions, however, the spelling is altered, but as he died soon after his description was published, the word has remained *Cinchona*, although pleas for its correct spelling have been made from time to time.

After the introduction of the bark into Southern Europe, its reputation gradually spread northward, but it was not until 1655 that it was known in England. Three years later one of our earliest

newspapers, "The Mercurius Politicus," contained an advertisement offering for sale "an excellent substance known by the name of Jesuit's Powder." which had been brought over by an Antwerp merchant. A Dr. Talbor used the remedy largely in the reign of Charles II., the king himself being cured of fever by its aid. This physician also had the good fortune to cure the Dauphin of France, which brought him into favour with Louis XIV., who paid him 2,000 louis d'or and an annual pension of 2,000 livres to publish his mode of treatment. This was found to consist of the administration of the bark infused in wine—something similar to the quinine wine of the present day. The particulars of the remedy were published in England in 1682, and since that time Cinchona bark has been accepted into the domain of regular medicine.

The hardships of the collectors in the primeval forests were of the severest kind. They were principally natives in the pay of speculators and companies, who were termed cascarilleros, from the Spanish word cascara, signifying bitter. Having selected the tree, its stem generally had to be freed from the climbing and other plants with which it was encircled, and after beating, the sapless outer bark was readily removed. Then by transverse and longitudinal incisions the valuable inner bark was stripped as high as could be reached. After felling, the peeling was completed and the bark dried either by natural or artificial heat. That from the smaller branches rolled up into quills or tubes similar to cinnamon bark, that from the trunk was made to dry flat by being weighted. It was then known as table bark. Formerly the root bark was neglected, but even that is now largely used by the alkaloid manufacturer. It was conveyed to the coast in serons of raw bullocks' hide, each weighing about one hundred pounds.

The above reckless system of bark cutting and collection, resulting as it did in some districts in the extinction of the trees, aroused the attention of European botanists. About the year 1830 its cultivation on a large scale was attempted in other countries. After several unsuccessful trials the Dutch Government in 1834 shipped forty-one cases of young plants to Java, but with every care they did not reach their destination in good condition, so at the end of two years, only about one-third were alive. It was soon discovered that the collection of the seeds was the more satisfactory plan, and by this method the plants grew and flourished in the hilly parts of North-West India and the Madras Presidency, so that in 1866 there were more than one-and-a-half million plants on the Neilgherry hills alone. Since 1867 the bark has reached us from these plantations in ever-increasing quantities. For many years Ceylon has also produced large supplies. In India it was found that if at the end of eight or nine years the trees were cut down the younger shoots yielded very fine bark. A system of "mossing" was introduced by McIvor, who enveloped the growing shoots with a layer of damp moss. The yield of alkaloid was increased by this treatment, and the growth of renewed bark promoted. Another plan of mossing is to remove longitudinal strips of the bark and cover the exposed portions with moss. Later the unstripped parts are treated in a similar manner, and a large yield of bark obtained without destroying the trees or their vitality.

Without taking into consideration those alkaloids unimportant from a commercial standpoint, and which are only contained to a very small extent in certain species, the four principal ones are quinine, quinidine, cinchonine and cinchonidine. Certain secondary principles are also developed during the treatment of the bark, the principal being a substance known as quinoidine. This consists of resinous and colouring matters, with the alkaloids more or less changed by the heat acids and chemical treatment to which they have been subjected. This body, also known as amorphous quinine, is obtained from the liquors from which sulphate of quinine has been crystallised, and bears about the same relation to true quinine as uncrystallised sugar does to commercial sugar. It is found that different barks derived from the same species vary greatly in richness of alkaloids, and that equal fluctuations occur in their relative proportion. As much as 13 per cent. of total alkaloids have been found in some specimens, whilst in others they are altogether absent. The alkaloid principally used in medicine in this country is quinine, in the form of the sulphate, but as most barks also contain large quantities of cinchonine and cinchonidine, uses have been found for these, principally in India. In fact, the whole four have very similar medicinal properties, and by some authorities quinidine has been credited with being more active than quinine itself.

Cinchonine, and probably the other alkaloids, yield when distilled with caustic potash an oily liquid choline, a body that exists in coal tar, and which forms with acids, crystalline salts. Imported cinchona bark is never uniform in quality, in the amount of alkaloid it contains, and a sample of every bale or seron is analysed before it is offered for sale. Its value is regulated by the amount of quinine it yields, the price being stated in "units," that is, so much per pound for every percentage of quinine it contains, a bark yielding 5 per cent. at a penny per unit would be worth fivepence per pound.

The alkaloids are according to Howard chiefly contained in the cellular tissue, but no definite knowledge has yet been obtained of the exact steps by which it is formed, nor have the numerous endeavours made to build up quinine from its elements been attended with any marked success. In the leaves quinine appears to be present in only minute quantities. A larger amount is found in the stem bark, and this slightly increases towards the root, where it again decreases, cinchonine being there present in a larger proportion.

Among the unimportant alkaloids are quinamine

(or paytine), paracine, pitoyine, cusconine, aricine and cinchovatine, this latter being said by some authorities to be identical with cinchonidine. The composition, characters and medicinal action of most of these are, however, not definitely known, and they are of no commercial importance. Although as previously stated the value of this bark was known in 1638, it was not until 1810 that attempts were made to determine its active principle. In that year Gomez (or Gomes), a Portuguese, obtained a mixture of alkaloids which he named Cinchonino, and this was shortly afterwards shown to consist of quinine and cinchonine. A few years later quinidine and cinchonidine were discovered. Although differing in many respects, quinine and quinidine have the like chemical composition, whilst in the same way cinchonine and cinchonidine are identical. The exact detail of the manufacture of these alkaloids on a commercial scale is kept a profound secret.

The alkaloids appear to exist in the bark in combination with kinic (or quinic) and quinotannic (or cinchotannic) acids. This latter by atmospheric oxidation is converted into cinchona red or cinchofuloic acid, a colouring matter which is contained in some species of red bark to the extent of 10 per cent. Quinovic acid, which is a constituent of the rhizome of *Potentilla tormentella*, has also been found in Peruvian bark, together with an amorphous bitter principle, quinovin. These two substances are stated to have tonic properties, whilst kinic acid is practically inert. The ash yielded by cinchona bark does not exceed 3 per cent.

An acid solution of sulphate of quinine, or sulphate of quinidine, has the property of being fluorescent. A very delicate test for these alkaloids is the green precipitate or coloration obtained by adding to either of their solutions of bromide, or chlorine, water and ammonia. By this means one part in 200,000 is readily detected. This is known as the Thalleioquin test. The bitter taste of quinine is also appreciable in very dilute solutions.

The chief value of this bark and its alkaloids is as an antiperiodic, especially in intermittent fevers; the bark is also largely used as a tonic, but the inconvenient bulk and uncertainty of composition, except in standard preparations, renders it a far less eligible form of medicine than the alkaloids themselves, although the other constituents of the bark, especially the cinchotannic acid and cinchona red appear to have a slightly different medicinal action. Quinidine has been shown to be the most active alkaloid, but being yielded in any quantity by only a few species, it is not in general demand. As it has been conclusively shown that cinchonine and cinchonidine have a similar action to quinine, but to a lesser degree, it is a regrettable waste that only small quantities are used in this country. For medicinal preparations of the bark the present pharmacopoeia directs that only cultivated red bark may be used, that must contain from five to six per cent. of total alkaloids, of which not less than half shall consist of quinine and cinchonidine. Besides the sulphates above mentioned, hydrochlorates, valerianates, tartrates, citrates, phosphates, tannates, bromides and iodides, are in more or less frequent demand as remedial agents.

Importation of spurious cinchonas is now very rare, but the substitution of inferior for good varieties is frequently noticed. To determine their true value with certainty, chemical analysis must be resorted to, the percentage of quinine being the only criterion of value. There is, however, one so-called spurious bark, *Remijia pedunculata*, known as cuprea or copper coloured bark, which actually yields quinine, and this is very valuable to the manufacturer of that alkaloid. It contains in addition cinchonine, cupreine, and homoquinine, or ultraquinine, the two latter being without any medicinal value. Another variety of cuprea bark, *Remijia purdiana*, is the source of cinchonamine, and it also contains cinchonine.

Curzon Terrace, Leicester.

COLLECTION AND PREPARATION OF FORAMINIFERA.

By Arthur Earland.

(*Continued from page* 9.)

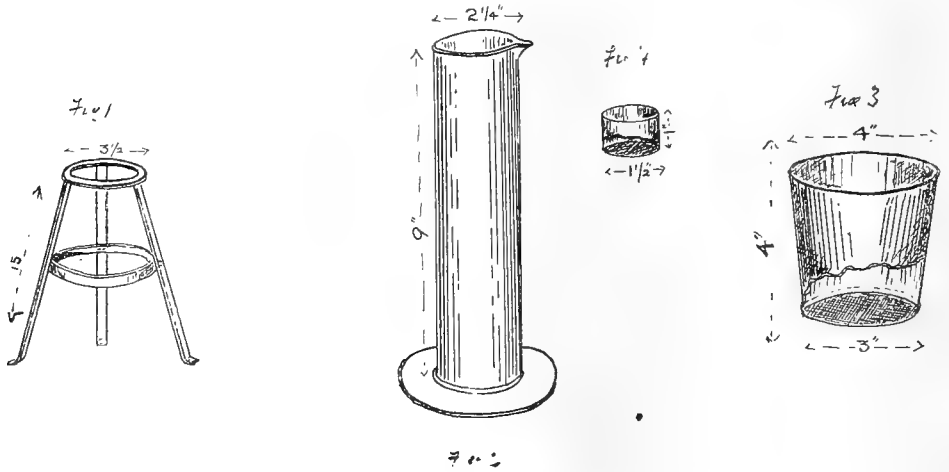
Preparation.

THE cleaning and preparation of the foraminiferous material may be deferred for any length of time, provided it has been thoroughly dried before being packed away. Unless this is done, the presence of so much organic matter will favour the growth of fungoid mycelium, which not only entails much additional labour in the cleaning process, but also destroys that glassy transparency which is the great charm of the hyaline foraminifera. The most extreme care will, however, sometimes fail to prevent the growth of mycelium in uncleaned material, and gatherings sent from abroad frequently reach this country with the particles matted together with the fungoid threads. I have successfully cleaned such gatherings by boiling in a strong solution of washing soda, which dissolves the mycelium. After washing away all trace of the soda, the material should be thoroughly dried, and if considered necessary, it may be absolutely sterilised by covering the sand for a few hours with methylated spirit. It is, however, much the best to clean the material as soon as possible after collection, thereby lessening its bulk and obviating any risk of loss from mould. The apparatus required for the purpose is simple and inexpensive, and much of it may be improvised if necessary.

I will, with assistance of a few figures, describe

some of the most useful pieces of apparatus: Fig. 1 is a tripod which can be made by any working smith. The legs are formed of iron rods rivetted to two rings of hoop iron. My tripod is 15 inches high, and $3\frac{1}{2}$ inches across the top ring. It is used as a support for the sieves during the washing process, in order to leave the operator's hands free. A retort stand with rings of suitable size will answer the purpose equally well.

Fig. 2 is a tall glass cylindrical vessel, used for the separation of the floating foraminifera. Such jars can be obtained of any chemical apparatus dealer. The spout which appears in the figure is not essential, although a very useful feature. It is 9 inches high by $2\frac{1}{4}$ inches diameter. The essential points in such a jar are (*a*) perpendicular sides without neck or constriction of any kind to prevent the foraminifera rising to the surface; (*b*) a foot so that it may stand unsupported; (*c*) it must be of glass, so that the operator may watch the rising of the floats and judge the correct time for straining them off. An opaque vessel is almost useless for the purpose.



Apparatus for Preparation of Foraminifera.

Figs. 3 and 4 represent two kinds of sieves, which can be made to order by a coppersmith. The larger sieves are four inches high, four inches across the top, sloping to three inches bottom diameter. They are made of sheet copper or zinc. Across the bottom a piece of wire gauze is strained and soldered to the outside edge so that there is no ledge of solder inside the sieve to retain unwashed material. The smaller sieves are made of $1\frac{1}{2}$-inch brass telescope tubing, and are one inch deep, the gauze being soldered on in the manner already described.

The wire gauze may be obtained through any large ironmonger, and is of varying degrees of coarseness from 10 to 120 meshes to the linear inch. The price, which increases with the fineness of the mesh, ranges from a few pence to four shillings a square foot, the smallest quantity obtainable. The coarser gauze is generally of brass wire, copper being used for the finer mesh. The most useful sizes, in my experience, are 120, 80, 40, 20 and 12 meshes to the inch, and the collector will do well to provide himself with as large an assortment of sieves as possible, for the subsequent labour of examining the material under the microscope is greatly lessened, if the material has first been divided into numerous grades of fineness. The 120-mesh copper gauze is, I believe, the finest metal gauze readily procurable, and for most materials it is fine enough, as the apertures are only $\frac{1}{200}$th of an inch in diameter. With some materials, however, it is necessary to use a sieve with smaller apertures. This may be effected by silver-plating a piece of the 120-mesh gauze so as to reduce the size of the apertures, or preferably by using the silk gauze prepared for millers, which can be bought of various grades up to 240 meshes to the inch. In order to use it, the collector must have a sieve made similar to fig. 3,

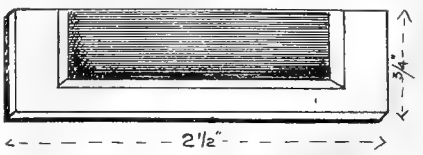


Fig 5

but without a bottom. The gauze is then stretched across and secured with a rubber band.

Fig. 5 is a tray used for picking over material under the microscope. It is made by covering a piece of cardboard with coarse black ribbed silk. A piece of wood, or thick card, is then cut to the shape of the figure and glued on the top. When the forams are placed on the tray, a gentle tap scatters them over the surface, and the ribbed silk prevents them from rolling down, when placed on the inclined stage of the microscope.

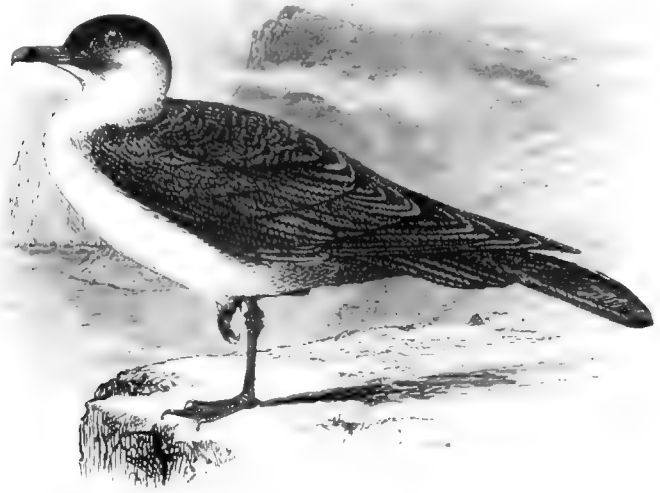
(To be continued.)

BOOKS TO READ

NOTICES BY JOHN T. CARRINGTON.

An Illustrated Manual of British Birds. By HOWARD SAUNDERS, F.L.S., F.Z.S., second edition, revised, xl. + 770 pp., 8¼in. × 5¼in., illustrated. (London: Gurney and Jackson, 1808-9.) 20s.

The second edition of this standard work, issued in twenty monthly parts, was completed with the June number, with which are coloured maps of the British Islands, Europe, and the North Polar Region. The whole work forms the most concise and at the same time trustworthy book on birds of a single region that has ever been written. The illustrations have been thoroughly overhauled and many redrawn. They are most accurate in delineation, and some have a lifelike piquancy which has seldom been excelled. The additions are chiefly by Messrs. C. Whymper and G. E. Lodge. By permission of the publishers we reproduce an example of Mr. Whymper's drawing in that of the Pomatorhine Skua. This work is one of the very best on British Birds for public libraries or private use, as it contains all the additions, and latest information upon British Bird Fauna.



POMATORHINE SKUA. (*From Saunders' "British Birds."*)

Applied Geology. By J. V. ELSDEN, B.Sc., F.G.S., Part ii., 254 pp., 8¼in. × 5¼in., illustrated by 186 figures. (London: The Quarry Publishing Co., Limited, 1899.) 5s.

The author has had the somewhat difficult task of writing the chapters constituting this book in such a manner as to satisfy geologists, and men interested in stones and metals from a commercial aspect. It was not easy, as the danger of being too elementary for the one, and too technical for the other, had to be avoided. This second portion of Mr. Elsden's work is full of interest for the latter class. The illustrations are helpful, and judiciously chosen.

Cries and Call-Notes of Wild Birds. By C. A. WITCHELL. xi. + 84 pp. 7½ in. × 5 in., with musical illustrations. (London: L. Upcott Gill, 1899.) 1s.

Mr. Witchell has for some time past given attention to the notes of our British wild birds, and it will be remembered he was the author of a work entitled the "Evolution of Bird Song," which we noticed at the time of issue. The book before us is an attempt to indicate the call-notes, that are familiar to those interested in birds. It is a very difficult subject to lucidly demonstrate, and requires more than ordinary courage to write a book on this subject. Considering the familiarity of mankind with birds and their songs it is astonishing that so little is understood about them. Mr. Witchell and the publishers deserve praise for producing this popularly arranged book, which cannot fail to arouse interest, and extend the study of bird notes, a pursuit that may be followed at all seasons of the year.

Flora of Kent. By FREDERICK JANSON HANBURY, F.L.S., and EDWARD SHEARBURN MARSHALL, M.A., F.L.S., lxxxiv. + 444 pp., 7½in. × 5in., with one plain and one coloured map. (London: Frederick J. Hanbury, 37, Lombard Street, 1899.) 12s. 6d.

The compilers of this new flora of Kent, which was so much needed, are both well-known botanists, the former being the editor of the last edition of the "London Catalogue of British Plants," and author of his celebrated "Monograph of the British Hieracia." No pains have been spared to make this flora as complete as possible, for which purpose all herbaria and botanical literature likely to throw light on the subject, have been examined. The investigation has continued since 1872, when Mr. Hanbury first commenced to accumulate records and facts regarding the flora of Kent. Among those who have helped, appears a list of upwards of a hundred well-known names, who have materially contributed

to the success of the volume. To these are appended a list of books and papers quoted or consulted, and a list of the herbaria examined. Prefacing the flora proper, is an important introduction dealing with contingent subjects, such as Topography, Drainage, Altitudes, Geology, Meteorology, Delineation of the Botanical Districts, and Botanical Notes. There is also a comparative table, extending over about twenty pages, of the plants occurring in Kent and the adjacent counties of Essex, Middlesex, Surrey, and Sussex. Another important feature is an Historical Summary of the Botany and Botanists of the County, by Mr. B. Daydon Jackson. The flora before us does not include the Cryptogamia, but it is hoped Messrs. Hanbury and Marshall may issue that section at a future time. The situation of the county with regard to the rest of the British Isles, and the great diversity of soil and locality, render it one of the richest regions in these Islands. There are recorded approximately eleven hundred and sixty species of phanerogams, found growing within its boundary. It is especially rich in orchidaceous plants, no less than thirty-three of the forty-four British species being found.

Rambles with Nature Students. By MRS. BRIGHTWEN, F.E.S. 323 pp., 8in. × 5½in., with numerous illustrations by Theo. Carreras. (London: Religious Tract Society, 1899).

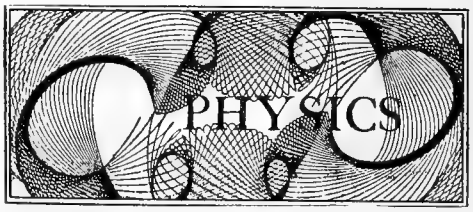
This is one of Mrs. Brightwen's well-known, pleasantly-written books for young people. Her object is to induce those who have opportunity of rambling through rural districts to observe and search for the reasons of the many wonders of Nature surrounding them. The book is divided into months, and familiar objects for each are figured and accompanied by chatty explanations. The whole is beautifully illustrated with a frontispiece and nearly one hundred and fifty drawings. It is a book to be recommended to the unscientific lover of Nature and country lore, for whom it is intended.

All About Birds. By W. PERCIVAL-WESTELL. 176 pp., 7½in. × 5in. (London: Feathers Publishing Co., Limited, 1899.) 1s. 6d.

Considering the sweeping title of this little book, we hardly wonder that the author finds it necessary to commence his preface with an apology. One would have thought it would not have been difficult to select some other, which would have more correctly described its contents. Its pages are occupied by an apparent reprint of a scrap-book in which the author seems to have pasted all sorts of newspaper cuttings and jottings from other sources, which refer to birds. Some are amusing and others probably true. As an example we quote one on page 25. "'Them eggs is mighty old,' remarked Uncle Swayback to the waiter; 'I'll bet them's the Lays of Ancient Rome, I've heard tell of.'" Again, the author informs us that "a pelican's pouch is large enough to contain seven or eight quarts of water." Doubtless the author on issuing this literary effort felt as proud, as did "a hen when it laid a foundation stone"; perhaps he may include this "fact" in his next edition.

Entomological Society of Ontario. Twenty-ninth Annual Report, 1898. 120 pp. 9½ × 6½ in. Illustrated with 67 figs. and two portraits. (Toronto: Warwick Bros. & Rutter, 1899).

The portraits illustrating this Report are of two past presidents, Messrs. W. H. Harrington, F.R.S.C., and John Dearness, I.P.S.. There are many articles of considerable interest in this Report, which is very fully illustrated, and Mr. H. H. Lyman's address.



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COHERERS. — Branly has recently modified his metallic disc coherer by substituting a row of balls, 1 cm. diameter. These are found to be very sensitive, but the sensitiveness greatly depends upon the material of which the balls are made. Brass and lead are useless, but by mounting ten balls of soft iron, one above the other, an initial resistance of about 990 ohms is obtained. This is reduced to 60 by a spark of 1·5 mm. passing at a distance of 10 metres. A slight shock sends the resistance up to 1,300 ohms, and a second spark brings it down again to 80 ohms. Hard steel balls produce similar results. A ball coherer, consisting of six hard steel balls, is about equal in sensitiveness to a coherer of gold filings. Care has to be taken, however, in regulating the de-cohering tap or shock. A sensitive coherer may also be constructed by enclosing a drop of mercury in a glass tube between two cylindrical brass electrodes.

BLACK RADIATORS.—The efficiencies of the various black materials used in coating instruments for radiant heat, have been investigated recently by Kurlbaum. A bolometer is exposed to radiation from a standard body in the shape of an orifice of a hollow cylinder of brass, blackened inside and heated on the outside by steam. This orifice may be covered by a diaphragm on which is deposited lampblack, or platinum black, kept at the same temperature. The radiation from these sources may thus be directly compared. The results are different. The absorbing, and therefore the radiating, power of lampblack increases rapidly with the thickness of deposit, while that of the platinum black, although it also increases, does so much more slowly. The results of the experiments show that the latter is the better for most purposes.

RECORDER OF PHOTOMETRIC READINGS.—When taking photometric readings the illumination of the scale is generally a drawback, as the retina gets fatigued and therefore temporarily less sensitive. To overcome this disadvantage use has been made of the following arrangement. A cylinder of wood is mounted with its axis parallel to, and somewhat below, the top of the photometer bar. At the end of a spring, attached to the photometer carriage, a steel point projects downwards nearly to the surface of the cylinder. By means of a rachet wheel arrangement, the cylinder can be advanced a certain angular amount. The paper upon the cylinder is at the same time punctured by means of a steel point. The observer can thus take a series of readings.

MULTIPLE IMAGES.—Some recent experiments of Mr. Shelford Bidwell have shown that the undefined image of a luminous object, produced upon the retina of a normal eye appears to be composed of a crowd of separate images of that object If say, the filament of an incandescent lamp is looked at through a lens, concave or convex, of about 15 cm. focal length from a distance of a few feet, numerous separate images of the filament are seen, some brighter than others. The number of these images increases as the distance of the observer from the lamp is extended, or when the lens is placed farther away from the eye.

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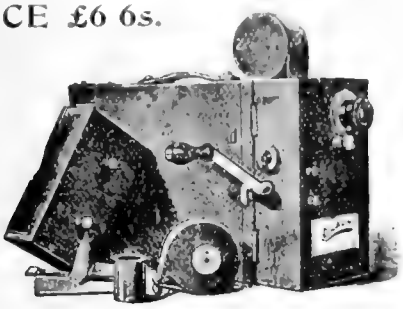

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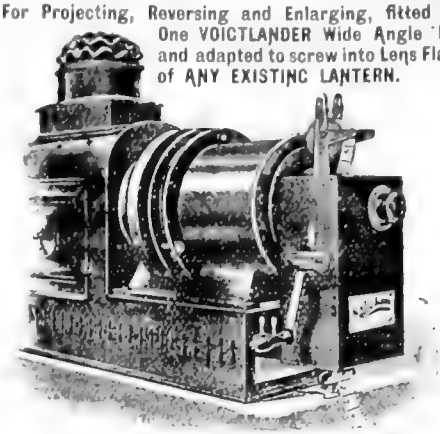

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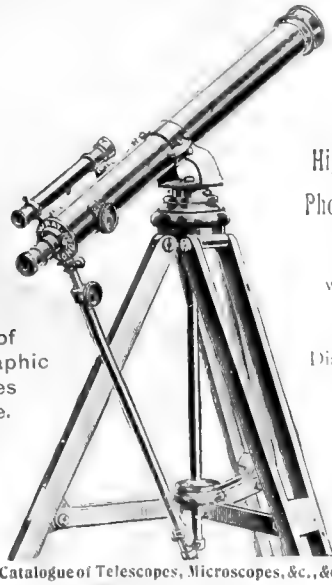

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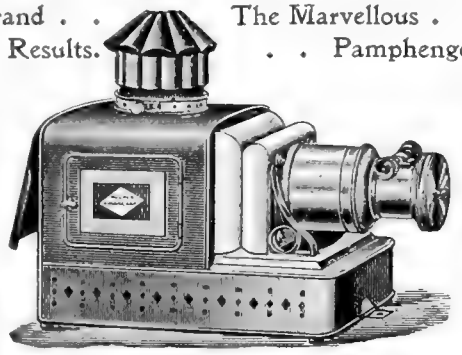

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MICROSCOPY

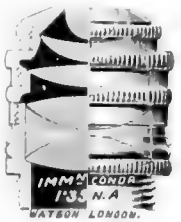
CONDUCTED BY F. SHILLINGTON SCALES, F.R.M.S.

SUGGESTED LIST OF PONDS.—A correspondent writes to us suggesting that considering the almost universal interest taken by microscopists in pond life, it would be useful if a list of productive ponds and the specimens likely to be found there, were to be published in these columns, and also that suggestions might be given monthly for the maintaining of aquaria. We shall be glad to carry out this proposal, if possible, and hope some of our readers will write, giving their brother workers the benefit of their knowledge and experience in this respect. We are now in the middle of summer, when pond-hunters are busiest, and letters on the subject should reach us promptly if they are to be of service. The readers of SCIENCE-GOSSIP have always been ready to help each other, they have here an excellent opportunity. In the meantime we may call attention to a well-known little book by Mr. Henry Scherren, entitled "Ponds and Rock Pools," as well as to the older volume by Mr. H. J. Slack on the "Marvels of Pond Life." Both these little books have merit in being inexpensive, as well as practical.

CHAS. BAKER'S NEW CATALOGUE.—Mr. Chas. Baker has sent us his new and enlarged catalogue which is a great improvement on former issues. Mr. Baker lists and illustrates not only his own well-known microscopes, but those of Zeiss, Leitz, and Reichert. A great many slides are included, but the prices of these are, we think, in most cases, somewhat high. Attention has been called in a former issue of this journal, to this firm's slide-lending department. A noticeable feature is the exceptionally complete series of stains and reagents prepared by the most scientific methods. There is a special catalogue of the necessary apparatus for the study of the effects of malaria upon the blood, bacteriological outfits, etc. The preface states that microscopes are included that are suitable for engineering, brewing, baking, paper-making, and other industries, but the suggestion that a dissecting microscope, and "if anything more than this be required" a binocular microscope, fulfils the requirements of the scientific papermaker, scarcely shows an intimate knowledge of the requirements of that particular branch of manufacture.

CIRCUIT STAGE "VAN HEURCK" MICROSCOPE.—Messrs. Watson and Sons have recently put upon the market a modification of their well-known "Van Heurck" microscope, which, by allowing more room between the stage and the body, gives complete rotation to the former. This is a step in the right direction. It has always appeared ridiculous that costly and elaborate microscopes of this sort should be, as we have seen them, sent out with mechanical stage, centering adjustments, graduated divisions for rotation, and even rack and pinion for the same purpose, yet incapable of rotation for more than, say, 270 deg., through the screw heads of the mechanical stage fouling the body of the instrument. We hope other makers of similar instruments will follow so good an example.

OIL IMMERSION CONDENSER.—Messrs. Watson and Sons, of High Holborn, have sent for our inspection one of their new "Parachromatic Oil Immersion Condensers." We have examined this critically, and are able to speak in the highest terms of its performance. Our readers will be aware that for an objective to work at its best the aperture of the condenser should approximate to that of the objective. Though it is not every objective that will stand so large a cone of light, the best of our immersion lenses need a larger aperture of illumination than the 170 deg. or so, that can nominally be passed through them with an ordinary dry achromatic condenser. The total aperture of this condenser is 1.35 N.A., and its aplanatic aperture is between 1.25 and 1.3 N.A. The clear aperture of the back lens is 6/10 inch, and the power of the condenser is equivalent to an objective of ¼ inch focus. It works through a slip 1·75 millimetres thick, and the makers state that to get the best results the lamp should not be less than 5 inches, or more than 7 inches from the back of the lens. With this condenser and a fine achromatic immersion objective of similar aperture, we have obtained results that closely rival the apochromatics. We think it will, therefore, soon be looked upon as an essential part of the outfit of the student of bacteria, the diatomist and others. The price is so moderate as to bring it within the reach of most microscopists. The optical portion only, with universal objective thread, as illustrated, costs £5, whilst the whole mounted with iris diaphragm, graduated to show aperture in use, stops, and revolving carrier is £6 10s.



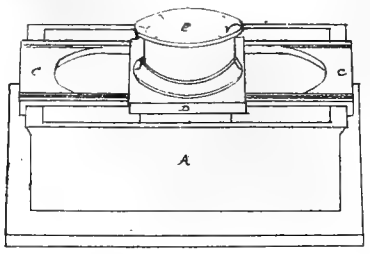
OIL IMMERSION CONDENSER.

MICROPHOTOGRAPHY WITH PORTRAIT LENS.—I enclose a photograph of a grain of barley, taken with the object of making a lantern slide, showing the growth of the roots in malting. It is an instance of what can be done in very low power photomicrography with a portrait lens, and ordinary half-plate camera. The lens used was a Dallmeyer patent Stereo, working at f. 4, but I believe any good portrait lens would have been equally efficient. The barley was stained with methyl-green in order to get rid of the difficulty of taking a pale yellow object successfully on a white ground and fixed on a piece of opal glass an Ilford opal plate with the emulsion cleaned off then photographed in the same way that an engraving would be copied. The grain of barley was illuminated on one side with an acetylene lamp, and on the other with the gaslight of the room, the object being to get a slight shadow on one side, so as to give an effect of perspective to the picture. The plate used was a Lumiere yellow green orthochromatic, and the exposure was twenty minutes. It is often desirable to take photographs and make lantern slides of objects requiring only a very low magnification, and it may interest your readers to know that in this way such photographs can be successfully obtained. The magnification is about 2½ times. *R. C. Nelson, 19, Roker Terrace, Sunderland.*

NEW MICROSCOPE TROUGH.—The vexed question, of keeping fairly large aquatic objects alive under the microscope, for an indefinite period, has yet to be solved. Perhaps the following suggestion will lead

others to perfection. A rectangular trough (fig. 1 A) 10 cm. long, 7·5 cm. wide, 3 cm. deep, inside

Fig 1



measurements, is fitted with a thin patent plate glass bottom, such as is used for the best micro slides. This trough carries a frame (C) sliding transversely across its top in dovetails. This frame carries a smaller frame (D) sliding on it longitudinally, also in dovetails. The small frame has a circular aperture 4·5 cm. in diameter. In this aperture a cylinder (E) is fitted, sliding vertically, long enough when pushed down to barely touch the glass bottom of the trough. The bottom of this cylinder is fitted flush, with thin glass 4 cm. in diameter, the same as used for micro cover-glass. The joints to be waterproof. From this description it is evident the glass bottom cylinder, by means of the rectangular sliding frames, can be adjusted over any portion of the trough excepting the corners. The metal work must be non-corrosive with saltwater or freshwater, and the cement should not give off any oxide or other injurious matter. In use, supposing we have a fixed hydroid for examination, the trough being half filled with water, a loop of white silk is passed around the polypary of the hydroid, or better, to the substance to which it is attached. The free ends of the silk are each wound round a narrow strip of plate glass as long as the width of the trough. The glass strips are then sunk one at each end of the trough, thus—

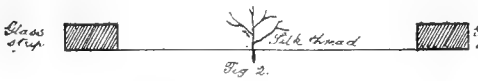
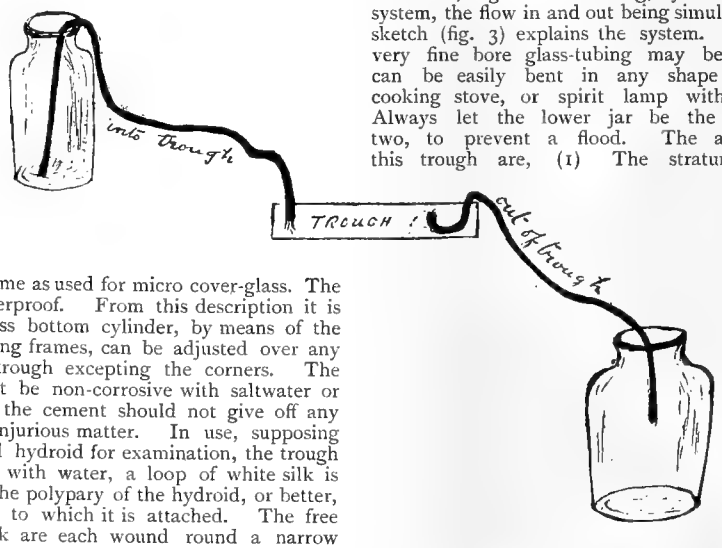


Fig 2.

This retains the object in any desired position, the centre of the trough, of course, being best. The cylinder is then centered over the slide, and carefully pushed down with a twisting motion until it touches the object. The trough is then placed on the stage of the microscope, which must, of course, be horizontal with the surface of the table, and its surface cleared of any upstanding screws, etc. Rack down the objective, say, a 1 inch, into the tube of the cylinder, and focus the object. Focus the sub-stage apparatus, and the object will be seen to perfection. It is convenient to have a tube 3 cm. long for the nose-piece. This is screwed to the nose-piece with the objective at the free end. This gives the objective more "play" over the surface of the bottom of the cylinder than it would have if the nose-piece of microscope were in the cylinder. This tube being 3 cm. long, the correction of the objective can be compensated by shortening the draw-tube 3 cm. Of course, this tube is of no use for the binocular. It is not advisable to use a higher power than $\frac{1}{3}$ inch or $\frac{1}{4}$ inch, for fear of breaking the bottom of the cylinder. It is convenient to have three or more troughs to the one frame and cylinder. When the object is not under examination it is unnecessary to keep the cylinder over; it is therefore available for the other troughs. Objects may be kept in these troughs, always ready for examination, for weeks. It is well to change the water, night and morning, by means of a syphon system, the flow in and out being simultaneous. The sketch (fig. 3) explains the system. For syphons, very fine bore glass-tubing may be used. This can be easily bent in any shape over a gas cooking stove, or spirit lamp with blow pipe. Always let the lower jar be the larger of the two, to prevent a flood. The advantages of this trough are, (1) The stratum of water



can be varied at will, to suit the object and the objective. (2) The fine glass and thin stratum of water produce little aberration in comparison with the time-honoured zoöphyte trough of Mr. Lister, of 1834. (3) The object is brought within reach of the sub-stage condenser. (4) Objects of fair size will live in the troughs, the large surface of water exposed to the air absorbing sufficient oxygen. It is not of vital importance to change the water daily as before recommended. (5) It does not leak. The disadvantages are, microscope must be used vertically. The apparatus is necessarily not particularly neat for the microscope stage, and not so easy to handle as the old Lister trough, but that, for accurate observation, is out of the question in 1899. Messrs. W. Watson and Sons, of London, are the makers of this accessory.—*G. West*, 128, *Kentish Town Road, London, N. W.*

MICROSCOPY FOR BEGINNERS.

By F. Shillington Scales, F.R.M.S.

In few things is a little initial advice and help more valuable, than when one is first taking up the use of an instrument like the microscope. We are constantly meeting those who are desirous of purchasing a microscope, and then learning how to use it; but who feel themselves bewildered at the very outset by the multiplicity of stands and accessories advertised by the various English and Continental makers. There are several excellent manuals to be obtained on the subject, but the keen competition of the present day makes it impossible for any book to keep up to date with the latest stands, etc. This especially applies to those less expensive and most recent stands, with which we shall mainly concern ourselves. At the outset, as the title of these papers plainly states, we shall disclaim any idea of teaching more experienced workers. Our aim is simply to indicate to the beginner, who, with much enthusiasm, little or no knowledge, and perhaps not too well lined a purse, proposes to take up study with the microscope. We shall indicate how he may to most advantage spend his money on the necessary outfit; what in fact are the essential requirements that he must look for in his instrument, whoever is the maker. Further, we shall explain what accessory apparatus will be required in addition. We shall then give a few practical hints on elementary management, on mounting, etc. The cost of everything will be kept as low as possible, but we shall not concern ourselves with an outfit suitable only for whiling away a pleasant hour or two, for "looking at pictures" in fact. Instead we hope to so advise the beginner, that afterwards, when he has gained experience for himself, he may feel that what he has bought is capable of showing him not only the infinitely little in Nature, but of enabling, if he so desires, to do real and serious work in medicine, in zoology, in botany, or in any other of the countless ways in which the modern microscope has become a necessity.

Let us start by enumerating the essential points that we shall require in our modern microscope.

There are practically two classes of stands—that with the pillar and horse-shoe, or equivalent form of foot, and that with the later tripod. The advantage of the former is that it is generally a little cheaper, and the sub-stage apparatus is more conveniently manipulated when the microscope is used in an upright position, as often happens to zoological and medical workers. In any other than the upright position, it is much less steady than the tripod form. For horizontal work, especially for micro-photography, it is quite top-heavy. The importance of this point can only be fully appreciated and verified by the practical worker. The result is that the tripod foot is daily coming more into favour, and we unhesitatingly advise it. The stand should of course be capable of inclination.

There must be a thoroughly reliable fine adjustment for focussing high powers. Here we would most strongly warn the intending purchaser against the kind of fine adjustment that moves the nosepiece at the foot of the tube. Most of the stands seen in provincial, and even in many London shops, have this kind of adjustment, but it is to be avoided, as sooner or later it will give its owner trouble. We will allude to more satisfactory forms, as we mention individual stands.

The coarse adjustment may be by either rack and pinion, the best makers fit now a *diagonal* rack that gives most soft and steady motion, without back-lash, or it may be an ordinary sliding adjustment only. Of course the former is preferable for anything but rough work. The reader will find the sliding adjustment perfectly satisfactory as far as it goes, and it often saves about 25 per cent. on the cost of the stand.

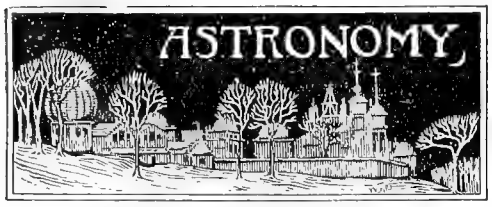
The screw for the objectives at the bottom of the tube should be what is called the "Society" size. In other words the size adopted and standardised by the Royal Microscopical Society, which provides the makers with the necessary templates. Nearly all good English objectives are now made to this size, and it has been adopted by best Continental makers.

The eyepieces unfortunately are less uniform in size, and, until recently, every maker had a size of his own. The Royal Microscopical Society recommends two standard sizes, the English size 1·35 inch, and the Continental size ·92 (about $\frac{1}{1}$) inch. Most students' stands are made for the latter or some approximate size, which we regret, as the larger eyepiece has several advantages. The mere diameter of the eyepiece does not, however, affect the magnification.

The Continental length of the tube is about 6 inches (say 160 millimetres), and the English length of tube is 10 inches (say 250 millimetres); this last being taken as the normal visual distance. We have no space for an explanation of the optical theory of the compound microscope, but we may here state that the aerial image of the object magnified by the objective is itself magnified by the eyepiece or ocular. The magnifying power of the individual ocular remains constant—that of the aerial image given by the individual objective depends upon the distance between objective and ocular. Therefore an objective and ocular used in a tube 6 inches long will give only $\frac{6}{10}$ of the magnifying power of the same objective and ocular in a 10-inch tube. We will allude to the practical bearings of this when we deal with objectives. It suffices to say here, that objectives made, or, as it is technically called, "corrected" for the one tube length, cannot be used for the highest class of critical work with the other tube length; though low powers, with low eyepieces bear the alteration fairly well. It is in consequence a great advantage to have a *draw-tube* that lengthens from 6 to 10 inches, so that objectives corrected for either length may be used on the same microscope. This draw-tube has also other uses that will be alluded to later. It is a *sine qua non*, when selecting a new instrument.

The stage should be large and rigid. The aperture should be of sufficient size to permit of the finger being inserted under the slide to enable one to "feel one's distance," when focussing high powers. One or two makers cut out the front of the aperture so as to make a horse-shoe opening. For use without the condenser this has some advantages. A mechanical stage is a convenience, but is not necessary for our purpose and is moreover expensive. It can often be added later. The mirror should have two faces, a plane and a concave one. The plane face should be "parallel worked" as it gives a truer reflection of the light. The whole should swing in a gymbal and slide up or down on a tail rod. We prefer that the latter should be circular and itself swing on a pivot, just beneath the stage.

(To be continued.)



CONDUCTED BY F. C. DENNETT.

1899 July	Rises. h.m.	Sets. h.m	Position at Noon. R.A. h.m.	Dec. ° ′
Sun ... 6	.. 3.52 a.m.	.. 8 17 p.m.	.. 7.1	.. 22.42
16	.. 4.4	.. 8.8	.. 7.42	.. 21.22
26	.. 4.16	.. 7.56	.. 8.22	.. 19.27

July	Rises h.m.	Souths h.m.	Sets h.m.	Age at Noon. d h. m.
Moon 6	.. 2.26 a.m.	.. 10.57 a.m.	.. 7.22 p.m.	28 5 40
16	.. 1.36 p.m.	.. 6.19 p.m.	.. 10.53 p.m.	8 15 29
26	.. 9.11	.. 2.55 a.m.	.. 9.16 a.m.	18 15 29

July	Souths h.m.	Semi-Diameter	Position at Noon. R.A. h.m.	Dec. ° ′
Mercury .. 6	.. 1.37 p.m.	.. 3'0"	.. 8.34	.. 20.17 N.
16	.. 1.53	.. 3'5"	.. 9.29	.. 15.0
26	.. 1.49	.. 4'2"	.. 10.5	.. 9.54
Venus .. 6	.. 10.40 a.m.	.. 5'3"	.. 5.37	.. 22.51 N.
16	.. 10.54	.. 5'1"	.. 6.30	.. 23.12
26	.. 11.7	.. 5'1"	.. 7.23	.. 22.25
Mars .. 16	.. 3.39 p.m.	.. 2'3"	.. 11.15	.. 5.39 N.
Jupiter .. 16	.. 6.19	.. 17'5"	.. 13.57	.. 10.41 S.
Saturn .. 16	.. 9.31	.. 8'3"	.. 17.9	.. 21.30 S.
Uranus .. 16	.. 8.31	.. 1'9"	.. 16.9	.. 20.55 S.
Neptune .. 16	.. 10.16 a.m.	.. 1'2"	.. 5.41	.. 22.8 N.

MOON'S PHASES.

	h.m.		h.m.
New .. July 7	.. 8.31 p.m.	1st Qr. .. July 15	.. 11.59 p.m.
Full .. ,, 22	.. 9.42 p.m.	3rd Qr. .. ,, 29	.. 0.42 p.m.

In apogee July 10th, at 4 p.m., distant 252,400 miles; and in perigee on 23rd, at noon, distant 222,200 miles.

CONJUNCTIONS OF PLANETS WITH THE MOON.

					° ′	
July 6	..	Venus	.. 3 a.m.	..	planet 1.0	S.
,, 10	..	Mercury†	.. 3 a.m.	..	,, 4.52	N.
,, 13	..	Mars†	.. 3 a.m.	..	,, 6.28	N.
,, 16	..	Jupiter°	.. 6 p.m.	..	,, 5.53	N.
,, 20	..	Saturn†	.. 2 a.m.	.	,, 2.26	N.

° Daylight. † Below English horizon.

THE SUN usually has spots upon it, but generally small. The sun is in apogee at 9 a.m. on July 4th.

MERCURY is an evening star, reaching its greatest elongation, 26° 59′ East, at 11 a.m. on 22nd. At the beginning of the month it sets 1h. 15m. after the sun, but the interval gradually decreases to 35 minutes at the end of July.

VENUS is a morning star all the month, rising a little more than an hour and a quarter before the sun. Its disc is gradually decreasing in size. At 10 p.m. on July 6th, it is in conjunction with, and only 46′ to the North of Neptune, but is then below our horizon.

MARS is now very small and uninteresting. He must be looked for as soon as he appears out of the twilight.

JUPITER may also be observed as soon as twilight will permit.

SATURN with his widely open ring, should be looked for a little later, advantage being taken of every steady evening. The Cassini division of the rings may be seen with comparatively small apertures.

URANUS may be observed as soon as it is dark enough to be seen.

NEPTUNE is a morning star, but too near the sun for observation.

METEORS may be specially expected about July 11th, 20—21st, and 25—30th.

SWIFT'S COMET is now fast travelling from us and decreasing in brightness. It had a nucleus on June 3rd, not exceeding 9½ magnitude, but on June 4th it had increased in brilliance to 6 magnitude.

TEMPEL'S COMET (1873 II.) has been recovered by Perrine of the Lick observatory. It was due to pass perihelion on June 18th. It was faint at the time of discovery.

HOLMES' COMET (1892 III.) was recovered by Perrine at the Lick Observatory on June 11th, very near its expected place.

PROFESSOR F. L. O. WADSWORTH has, according to "Science," been appointed by the managers of the Pennsylvania University, to succeed Professor J. E. Keeler as director of The Allegheny Observatory.

A GREAT MODEL OF THE MOON, in relief, 19 feet in diameter, has been added during the past year to Field Columbian Museum, Chicago, through the generosity of Mr. L. W. Reese. It was prepared from the maps of Beer and Mädler, and Schmidt. This model took five years to construct. Hitherto only sections had been accessible, and those at rare intervals.

MINOR PLANETS.—Three of the recently announced discoveries, two by Professor Max Wolf, and the other by Dr. Palisa prove to be re-discoveries. The total number of 444 are now known.

A NEW ALGOL VARIABLE, has been discovered in Cygnus by M. Ceraski of Moscow. It is situated in R.A. 20h. 2m. 24·5s., N. Dec. 45° 52·9′. Its normal magnitude is 8·6, and it decreases about two magnitudes. It was discovered on photographs taken from May to July, 1898.

DOUBLE STARS.—At the meeting of the British Astronomical Society on May 31st, Mr. E. A. Holmes read a paper on "A Year among Double Stars." After referring to his own observations, he endeavoured to account for the apparently little interest taken by members of the Society in this class of objects, as shown by the fact that the Director, Mr. G. M. Seabrooke, had failed to get a successful section formed. Mr. Holmes thought it was largely due to the pseudo-accuracy assumed when the distances were given to the second decimal place, and the position angle also running into decimals. In the ensuing discussion, the president, Mr. W. H. Maw, thought that no double star observer would care to bind himself to the accuracy of these figures; but at the same time they served a useful purpose when getting the averages of observations. Mr. G. F. Chambers frankly confessed that he was glad this section was not successful, as he thought the more fully equipped, large observatories were better fitted for the work. He considered there was much to do, such as the observation of planets, comets, and meteors, that was more suitable for the members of the Association.

TOTAL ECLIPSE OF THE SUN.—Mr. Maunder in the same meeting said that the individual cost of going next May to Spain, Portugal, or Algiers was expected to reach about £20 or £21. He already had received 109 names of those who desired to participate in the observations. The American Government, if notice be given them, will not demand duty on instruments taken there to observe the eclipse.

THE SUN'S SURFACE.—I was unable to observe the Sun on May 10th, 18th, 19th, 20th, and 22nd, can any of our readers inform me as to the presence of spots on either or all of these dates? Please address, F. C. Dennett, 60, Lenthall Road, Dalston, N.E.

CHAPTERS FOR YOUNG ASTRONOMERS.

By Frank C. Dennett.

USE OF THE TELESCOPE.

(*Continued from p. 27*).

In making observations of the moon, the position of the terminator should always be given. In other words it should be stated what objects are situated on the boundary, between brightness and shade.

If it be desired to observe faint objects, whether nebulae, comets or minute points of light, do not, for a long time before the observation, expose the eye to any brilliant light. Professor W. R. Brooks, who has discovered so many comets, will never allow himself to look at a brilliant light, that he may not injure the sensitiveness of the retina. Sir. J. F. W. Herschel used to prepare his eye by remaining for a quarter of an hour in a totally dark room. Never get excited before an observation, as the eye is not then in fit condition to see delicate detail. In looking for faint objects, if they are not at once seen, direct the eye to the edge of the field of view; but keep the attention in the middle, where they are suspected to be, and very often success will result. This is called using averted, or oblique, vision.

An hour or two after sunrise is usually the best time to observe the sun, before the atmosphere gets heated. If, however, the sun is an object of study, look at it, if possible, every two or three hours. Close double stars are often best seen on a still frosty evening with a slight fog. If the observer has an equatoreal with circles, an hour before sunset is a good time. An east wind often affects even double star observations, making the star discs triangular instead of round. The breaks between clouds are often better when looking for stars in daytime than an apparently clear sky.

If telescopes of larger aperture than 6 inches are being employed, definition may often be improved by using a "stop" to reduce the working diameter somewhat, when the air is not good. Such stops should be placed as near to the objective as possible. Reflectors should have a door in the tube just above the speculum, to permit of the insertion of stops, or for covering the mirror. If the air is unsteady early in the evening, do not give up; a little later there may be an improvement. In large towns the air generally improves after midnight. It is also often very transparent after rain has fallen. Early morning is a favourable time for observation.

When not in use always keep the objectives covered to prevent dust from settling upon them; and in the case of Newtonians cover the small speculum as well. This should be done in the open air, as to bring the telescope into the warmer atmosphere of the house would cause "dewing." If an objective is "dewed," do not close it up in that state, but bring it into the warmth near, but not close to, a fire and the dew will soon disappear. Do not attempt to rub a silvered mirror when damped, or it will remove the film. When it is necessary to clean an objective first remove any particles of dust with a camel's hair pencil, and then clean, aided by the breath, gently with a soft, even, chamois leather, or a soft silk handkerchief. When not in use the leather, or handkerchief, should be kept in a wide-mouthed stoppered bottle. For cleaning the eyepiece lenses, after the dust has been removed, nothing is better, when aided by the breath, than a piece of clean blotting paper rolled to a point and scraped with a knife. For the lacquered brasswork anything more than a duster will only damage the lacquer, and spoil its good appearance.

When lenses or eyepieces are to be screwed in, always give a back turn first and the threads drop in with a snap, then screw right away; otherwise delicate threads are often spoiled.

An equatoreal with circles requires three adjustments to get it into proper position, after being approximately placed. First turn the telescope, whilst east of the hour circle, to a star nearly on the meridian, and take the declination reading of the circle. Next reverse the instrument to the west side of the hour circle, set it on the same star and again take the reading. Halve the difference between the two readings and alter the vernier to read the mean. These double readings should be taken three or four times, until, whether the telescope is east or west of the polar axis, the readings of the declination circle are identical. Secondly, turn the telescope to any star, whose declination is known, close to the meridian, and as near the zenith as possible. Read its declination from the circle. If this does not agree with its declination given in the "Nautical Almanac" raise or depress the polar axis, until the readings tally, by means of the screw placed for that purpose. Thirdly, set the telescope on any known star about due east, and having an altitude of about 45°. Read its declination on the circle allowing for refraction, if accurate the polar axis of the instrument is truly in the meridian. If the north declination reads too great, the north end of the polar axis is too far east and *vice versa*. The whole instrument must be moved in azimuth until the readings are accurate. When these adjustments have been made, go over them all again for verification, after which the advantages of the equatoreal stand will be appreciated.

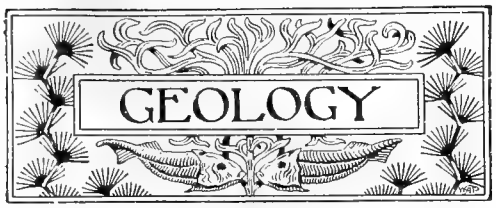
A good maxim to follow is that "every observation not intended as a mere relaxation, should be directed to ascertain some as yet unknown fact." Do not go to the instrument prepossessed with the intention either to see, or not to see any given object, or the probability is, there will be hallucination. Forgetfulness of this is the cause of many errors. It is best to go to the telescope, see as much as it will show, make careful notes of what is seen, and afterwards compare observations with those of others.

It is always well to wrap oneself up warmly, and to stand on a board whilst at work; but very little notice need be taken of the common prejudice against "night air." It is a fact that astronomers, as a class, are long-lived.

If it is desired to have an observatory, the cheapest, and for many reasons best, pattern to adopt, is the "Berthon." It was first described in the "English Mechanic," October 13th and 20th, 1871, by the Rev. E. L. Berthon For reflectors however, if it is desired to use them to the greatest possible advantage, the better plan is to have a cover that can be lifted right off, or that will wheel away on rails.

An excellent pillar to be used as a fixed stand for a telescope having a pillar and claw stand can be made thus:—Get a piece of iron drain piping 4½ in. to 6½ in. in diameter, and 9 ft. long. Sink the pipe 3 feet into the ground; preferably into concrete, then fill it with dry sand, to prevent vibration. Have three holes drilled around the top end of the pipe, and have a plug of wood turned so as to fit into it, tightly. Screws through the holes, will hold the plug firmly in place. There is a large screw holding the claw to the pillar. Get a corresponding screw made to attach to the wood plug. The pillar will then screw off the claw foot, and on to the column at pleasure. A coat of paint or enamel, makes an effective finish to a cheap and useful erection.

(*To be continued.*)



CONDUCTED BY EDWARD A. MARTIN, F.G.S.

A WEALDEN BIRD.—Mr. Neville Jones, a member of the London Geological Field Class, found a fragment of a bone in a sandstone of the Wealden Beds of Ansty Place, near Cuckfield, which has been identified by Prof. H. G. Seeley, F.R.S., F.G.S., as probably the distal end of the femur of a bird. He states that the external condyle is not only larger and deeper than the inner, but is more prolonged distally, this being perhaps the most distinctive avian character of the bone. *Colymbus* is the only existing bird to which the fossil has any approximation, but the resemblance is distant, and not suggestive of near affinity. It is interesting that the Cretaceous birds show so marked an affinity with that type. Prof. Seeley's paper on the subject will appear in the Quarterly Journal of the Geological Society, and is awaited with interest.

RAISED BEACH AT BRIGHTON.—In connection with our recent notes on this subject, our readers will be interested to know that at the Geologists' Association meeting at University College on June 2nd, a paper was read by Mr. F. Chapman, A.L.S., F.R.M.S., on "The Raised Beach and Rubble Drift at Aldrington, between Hove and Portslade-on-Sea, Sussex, with notes on the Microzoa." Since Mr. Johnson's note appeared in SCIENCE-GOSSIP last month, I have paid another visit to the quarry mentioned by him, and brought away thence from the grey sand beneath the Chalk Breccia, or Coombe Rock, a lump of greyish granite, originally 8 inches long. At first sight it appears to be exactly similar to those fragments which I obtained from the raised beach on the east of Brighton some little time since.

GEOLOGISTS' ASSOCIATION FIELD MEETING.—On June 3rd, members visited Reigate under the direction of Miss M. C. Crosfield and the Rev. Ashington Bullen, F.C.S. A visit was paid to Mr. Taylor's Colley Hill Quarry in the Upper Greensand. The pit gives a fine section, with numerous little faults on the east side of the quarry. Here, too, is the "Holocene" deposit, recently described by Mr. Bullen, affording *Bulimus montanus* and *Helix arbustorum*. A climb was made to the top of the hill to inspect a large block of cemented flints, weighing over a ton, lying in the red clay with flints. A junction of the Gault and Lower Greensand was examined in the Croydon Road, also in Bell Street. The Gault is exposed in the wine cellars in Bell Street.

FOLKESTONE FOSSILS.—Amongst fossil collectors to whom some of our best-known geologists have been indebted for specimens, is the veteran John Griffiths, who is still as enthusiastic in his pursuits as advancing years will allow. He would be glad to supply geological specimens to any of our readers who may communicate with him. His address is 4, Batley Cottages, Folkestone. There are exceptional opportunities at present in the Folkestone district in consequence of the several new colliery works in progress.

A GREAT auk's egg will be offered at Mr. Stevens' Auction Rooms, Covent Garden, on July 19th.

WE have received from Messrs. Dulau and Co., Soho Square, London, two catalogues, one devoted to books and papers on British Botany and the other to those on Astronomy and Meteorology.

THE Midland Malacological Society, at a recent meeting held in Mason University College, Birmingham, elected Dr. Henry Fischer of Paris, and Professor Pilsbry of Philadelphia, Pa., U.S.A. as honorary members of the Society.

THE Rev. Frederick Smith has favoured us with a reprint from the Proceedings of the Philosophical Society of Glasgow, of his paper entitled "Some Investigations into Palaeolithic Remains in Scotland." It is illustrated with four plates and some diagrams.

WE have received from Professor W. W. Watts, the Secretary of the Committee on Photographs of Geological Interest in the United Kingdom, appointed by the Bristol Association for the Advancement of Science, its Ninth Annual Report, submitted at the Bristol Meeting in 1898.

MESSRS. WILLIAMS AND NORGATE, the London publishers, are acting as agents for a novel illustrated monthly journal, to be devoted to photography, and published in four languages, namely, English, French, German and Dutch. The editorial offices will be 27, Marnixkade, Amsterdam. It promises to be of considerable literary and artistic importance.

DURING the year previous to the Bristol meeting the Committee on Photographs of Geological Interest received 250 new photographs, bringing the total number in the collection, to 2,001. Among them are some of exceptional interest including a set from Arran, Cumbrae, Ailsa Craig, and the Fifeshire volcanic necks, by Mr. A. S. Reid; raised beaches in Devon by Miss Partridge, and others.

THE promise of Mr. Balfour on behalf of the Government, to give substantial aid to the proposed British Antarctic Expedition, is most satisfactory. The very important deputations from the Royal Society and the Royal Geographical Society, that discussed the matter with the first Lord of the Treasury on the 22nd of June, could hardly fail to impress the Government of the necessity of such an expedition. Had it not been for private munificence, showing how earnest is the desire; we doubt that the national funds would have been so readily forthcoming

THERE must be many photographers with some knowledge of Geology, who can assist the Committee on Photographs of Geological Interest. Copies of Photographs should be sent unmounted to Professor W. W. Watts, Mason University College, Birmingham. The districts from which these are still most required are, N. and S. Wales, The Yorkshire Dales and Moors, The Malverns, around Oxford and Cambridge, Cornwall, The Southern Uplands, The Central Valley of Scotland, and Central and Southern Ireland. On application to Professor Watts gratuitous instructions may be received by those desiring to help in this work.

CORRESPONDENCE.

At the suggestion of several correspondents we open with this volume a department in which our readers may address the Editor in letter form. We have pleasure in inviting any who desire to raise discussions on scientific subjects, to address their letters to the Editor, at 110, Strand, London, W.C. Our only restriction will be, in case the correspondence exceeds the bounds of courtesy; which we trust is a matter of great improbability. These letters may be anonymous. In that case they must be accompanied by the full name and address of the writer, not for publication, but as an earnest of good faith. The Editor does not hold himself responsible for the opinions of the correspondents.—*Ed. S.-G.*

The Lassell Two-Foot Telescope.

To the Editor of SCIENCE-GOSSIP.

Sir,—In Greenwich Park, outside the Observatory, there is lying the tube of this noble instrument, one I believe, that has stamped itself on the annals of astronomy. With it, is also the pier which used to carry the telescope. I suppose its speculum is preserved in the adjoining buildings. William Lassell, who was born in 1799, and died in 1880, did much important work with this instrument. He it was, who in 1846, within 17 days after the discovery of the planet Neptune, detected from Liverpool its one known satellite, having the rare motion of revolving round its primary from East to West, contrary to the usual motions of the solar system. Lassell also conducted some observations at Malta.

My object in addressing you is to suggest that the telescope should be re-erected in some place within the boundary of Greenwich Park, so as to be available at a small charge for public use, or at least for amateur astronomers.

No great expense of establishment is necessary for the installation, which would doubtless prove a valuable educator of the people, and in time, popularize the study of astronomy. With regard to maintenance, the salary of an intelligent demonstrator should be recouped by the admission fees from the public, up to a certain hour, with extra fees for amateur astronomers during the rest of the night. This would be an inestimable boon to the latter class, as no such special opportunity now exists.

May I commend this suggestion to the Astronomer Royal through your columns, or if such is not within his means, to some public-spirited person or body, who would with his permission carry out this proposal. At present the telescope is useless, whereas if thus employed it would continue the work of one of England's broadest-minded men, to whose memory it would be a lasting monument.

I am Sir, Yours, etc.,
Frank C. Dennett.

60, Lenthall Road, London.

Wanted.—A Science Censor.

To the Editor of SCIENCE-GOSSIP.

Sir,—Cannot something be done to check the continual and puerile scientific inaccuracy one meets with in so many daily and other newspapers? This applies especially to those which are sold at a low price, and therefore have a circulation among a large class, already imperfectly educated. One hears that some of these papers pride themselves upon the fact of their being written and edited by "young men." The results, from a scientific point of view at least, are certainly such as would lead one to believe that this is the case. The general ignorance is so great among most of these writers, that few of them even know the value of the words "variety" and "species," as they are constantly interchanging them in a manner which is quite comic. Again, it is not uncommon to find special headlines and extravagant writing to announce some "discovery" which has been known for long past to those who are familiar with the respective subjects. I observe that you not infrequently give examples in your columns of scientific absurdities which have been seriously printed in respectable journals. I possess an interesting collection of such comicalities, but a perusal makes one feel sad, and suggests the necessity for the Institute of Journalists to take this matter in hand. I have only referred to newspapers, but the same inaccuracy is equally glaring in many weekly and monthly magazines.

Hater of Inaccuracy.

Exchange Clubs.

To the Editor of SCIENCE-GOSSIP.

Sir,—I have latterly taken much interest in our land and freshwater shells and have consequently a number of duplicates. These I have offered through your exchange column and certainly have had many replies. It would be far more satisfactory if one could see a number of duplicates of other collectors, so as to make choice of what one needs. This plan is successfully carried out by lepidopterists, and botanists, the latter for both flowering plants and mosses. Why can we not have an Exchange Club for Shells? I feel sure if one was started, with circulating baskets as conducted by the entomologists, it would get considerable support, especially in the winter season.

I am, Sir, Yours etc.,
Malacologist.

Science Appointments.

To the Editor of SCIENCE-GOSSIP.

Sir,—Has it ever occurred to you and your readers that considering the large number of persons who are now educated in Science, many of whom take their degrees as B.Sc. or D.Sc., how comparatively few are the available remunerative appointments through which they can afterwards earn money for the necessities of life.

When we enumerate the appointments in the national and other museums, the limited number of professorships in science in our Universities and other colleges, one or two places each with some of the County Councils and large commercial industries, we exhaust the list for Natural Science, which total is covered by three figures, pretty low down.

Most persons who have studied Science with a view to making it a profession have naturally come in contact with others like themselves out of work. The result of absence of appointments is that with the exception of those lucky or clever people, who have secured the plums, life resolves itself for them, into a long and anxious struggle.

The point I would venture to raise is, the question, whether young men and women should be encouraged, save in brilliant instances, to take up Natural Science as a living in England. Of course it is desirable that Science should be taught, even more widely than at present, but from the point of view of general education only.

I should be glad if you could open your columns to a discussion on the subject, as it seriously affects the welfare and aspirations of many of your readers.

I am, Sir, etc.,
—, B.Sc.

NOTICES OF SOCIETIES.

*Ordinary meetings are marked +, excursions * ; names of persons following excursions are of Conductors. § Lantern Illustrations.*

GEOLOGISTS' ASSOCIATION OF LONDON. *Excursions.*

July 1.—*Medway Valley. G. E. Dibley, F.G.S., and A. E. Salter, B.Sc., F.G.S.
,, 15.—*Guildford.
,, 22.—Cycling Excursion.
Aug. 3-9.—*Derbyshire: Peak Forest—Headquarters at Matlock Bath. One night at Castleton. H. Arnold Benrose, M.A., F.G.S., Dr. Wheelton Hind, F.G.S., and J. Shipman, F.G.S.

Frederick Meeson, Chairman, Excursions Committee, 29, Thurloe Place, South Kensington, S.W.

NORTH LONDON NATURAL HISTORY SOCIETY.

July 6.—+"The District round Deal." L. J. Tremayne.
,, 8.—*Broxbourne. R. W. Robbins.
,, 15.—*Tring Zoological Museum. W. H. Smith.
,, 20.—+"The Balance of Nature in relation to Man." M. Culpin.

SELBORNE SOCIETY—CROYDON AND NORWOOD BRANCH.

July 15.—*Reigate Heath.
Aug. 19.—*Belmont, Woodmansterne, and Chipstead.
Sep. 16.—*Mitcham Common to River Wandle.

SOUTH LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY.

July 1.—*Chalfont Road. R. Adkin, F.E.S.
July 15.—*Wisley, *via* Effingham. W. I. Ashdown.

Hy. J. Turner, Hon. Report Sec.

HULL SCIENTIFIC AND FIELD NATURALISTS' CLUB.

July 8.—*Yorkshire Naturalists' Union at Driffield.
,, 12.—+"A Search for the Red Deer in the Holderness Peat Beds." A. & B. Morfitt.
,, 26.—+"Advice to Young Microscopists." R. H. Philip.

YORKSHIRE NATURALISTS' UNION.

July 8.—*Driffield for Skerne and Wansford.
Aug. 5-7.—*Stokesley.
Sept. —*Fungus Foray, Campsall Woods.
Oct. —+Annual Meeting at Harrogate.

NOTTINGHAM NATURAL SCIENCE RAMBLING CLUB.

July 1.—*Trowell, Balloon Houses and Hemlock Stone.
,, 15.—*Hoveringham.
,, 29.—*Bulwell. J. Shipman, F.G.S.

TUNBRIDGE WELLS NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

July 15.—*Westerham and District. Mr. Trollope.
Aug. 12.—*Bidborough and Leigh (with Southborough Field Club). Mr. Freer.
Sept. 2.—*Pembury and the Borough Waterworks. H. S. Roberton.
,, 30.—(?)*Fungus Foray. R. R. Hutchinson.

Hon. Sec., R. R. Hutchinson, 28, Princes Street,

NORTH KENT NATURAL HISTORY SOCIETY.

July 1.—*Field Ramble.
,, 12.—+Local Wild Flowers. J. W. Cooper.
,, 20.—+Birds and their Tales. Rev. J. W. Horsley, M.A.

IMPORTANT NOTICE.

SUBSCRIPTIONS (6s. 6d.) for Vol. VI. are now due. The postage of SCIENCE-GOSSIP is really one penny, but only half that rate is charged to subscribers.

The Proprietor of SCIENCE-GOSSIP having decided to manage the business department from an independent office at 110, Strand, London, W.C., all subscriptions, advertisements and payment for advertisements must in future be sent to that address, and no longer to the Nassau Press, which latterly managed the commercial department for the proprietor.

NOTICES TO CORRESPONDENTS.

TO CORRESPONDENTS AND EXCHANGERS.—SCIENCE-GOSSIP is published on the 25th of each month. All notes or other communications should reach us not later than the 18th of the month for insertion in the following number. No communications can be inserted or noticed without full name and address of writer. Notices of changes of address admitted free.

BUSINESS COMMUNICATIONS.—All Business communications relating to SCIENCE-GOSSIP must be addressed to the Proprietor of SCIENCE-GOSSIP, 110, Strand, London.

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EDITORIAL COMMUNICATIONS, articles, books for review, instruments for notice, specimens for identification, &c., to be addressed to JOHN T. CARRINGTON, 110, Strand, London, W.C.

NOTICE.—Contributors are requested to strictly observe the following rules. All contributions must be *clearly* written on one side of the paper only. Words intended to be printed in *italics* should be marked under with a single line. Generic names must be given in full, excepting where used immediately before. Capitals may only be used for generic, and not specific names. Scientific names and names of places to be written in round hand.

THE Editor will be pleased to answer questions and name specimens through the Correspondence column of the magazine. Specimens, in good condition, of not more than three species to be sent at one time, *carriage paid*. Duplicates only to be sent, which will not be returned. The specimens must have identifying numbers attached, together with locality, date, and particulars of capture.

THE Editor is not responsible for unused MSS., neither can he undertake to return them, unless accompanied with stamps for return postage.

ANSWERS TO CORRESPONDENTS.

E.S. (Thornbury).—The caterpillars which attacked your apple trees, are of the moth *Bombyx neustria*. This species is frequently common and destructive in the south of England.

S.A.W. (Luton).—Your primrose is interesting, but a sport that occasionally appears. We have had several such brought before our notice this season. It may be the result of the small rainfall of the past two years.

D.D. (York).—(1) A good modern elementary book on Geology is Professor Watts' "Geology for Beginners" (Macmillan's, 2s, 6d.). It was noticed in SCIENCE-GOSSIP, November, 1898, Vol. v., p. 177. (2) Have applied to publishers for information.

C.B.S. (Beds).—Leach of Gt. St. Andrew's Street, London, supplies plants, fish, etc., for fresh water aquaria.

T.E. (Leicester).—The rose is a case of proliferation, which seems frequent this year.

EXCHANGES.

NOTICE.—Exchanges extending to thirty words (including name and address) admitted free, but additional words must be prepaid at the rate of threepence for every seven words or less.

OFFERED. A collection of coal measure plants, for an astronomical telescope or books. T. Stock, Radstock, Somerset.

DESMIDS. Wanted good gatherings of the rarer kinds. Offered, mounts of same, or other botanical, or insect slides. W. White, Litcham, Swaffham.

A NUMBER of fine micro-slides, photo-micrographic prints and negatives offered in exchange for British and Foreign echinoderms, crustacea, shells, beetles, &c.—H. W. Parritt, 8, Whitehall Park, N.

DEVONIAN, Rhaetic, Lias and Oolitic fossils. Will exchange for Cambrian, Perinian, London Clay, Gault, Brachlesham, or Crag fossils.—Dr. Brendon Gubbin, 15, Redland Grove, Bristol.

WANTED Miniature Spectroscope, adjustable slit. Offered, 1/8in. Micro objective, 115° angle, good.—F. C. Dennett, 60, Lenthall Road, Dalston, N.E.

WANTED from British localities *Clausilia biplicata*, alive if possible. Many species to offer in exchange.—G. Breeden, 304, St. Vincent Street, Ladywood, Birmingham.

WIMSHURST Electrical Machine, 12in. plates; two astronomical mirrors, 12in. and 6in. diameter; 6ft. focus; full-size magic lantern; snap-shot camera.—Offers, M. Lowe, 252, Spring Bank, Wigan.

WANTED Pilsbry's Manual of Conchology (Pulmonata), vols. 1 and 10. Offered, geological works, shells, or cash.—Miss Linter, Saville House, Twickenham.

MICROSCOPIC SLIDES wanted, of rocks and minerals. Dr. Roberts, Billesdon, Leicestershire.

FORAMINIFEROUS material or superior microscopic slides (miscellaneous) required in exchange for similar material or named specimens of Forams.—A. Earland, 28, Glenwood Road, Catford, S.E.

WANTED, Clutches Sideblown Eggs, with authentic data, in exchange for similar clutches, Hare Nightjar, Stone Curlew, Lesser Redpoll, Nightingale, Yellow Wagtail, &c.—L. W. Leader, Banham, Attleborough, Norfolk.

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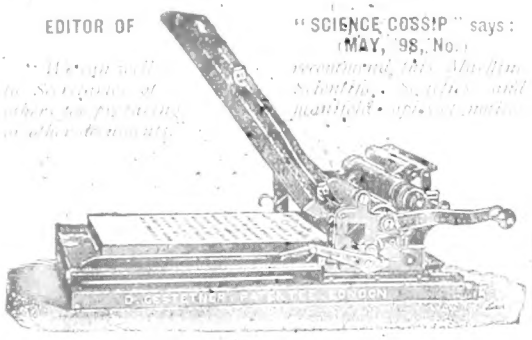

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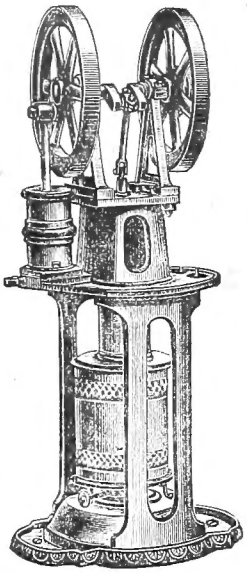

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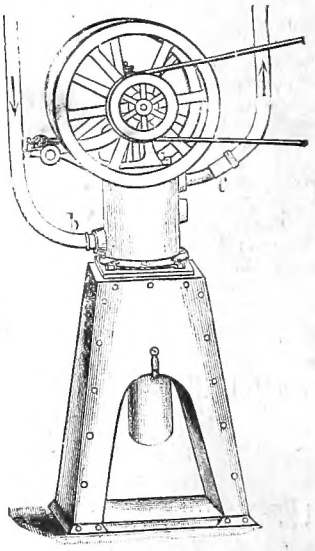

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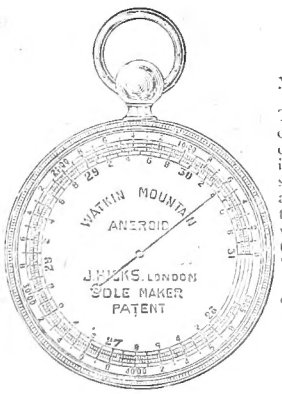

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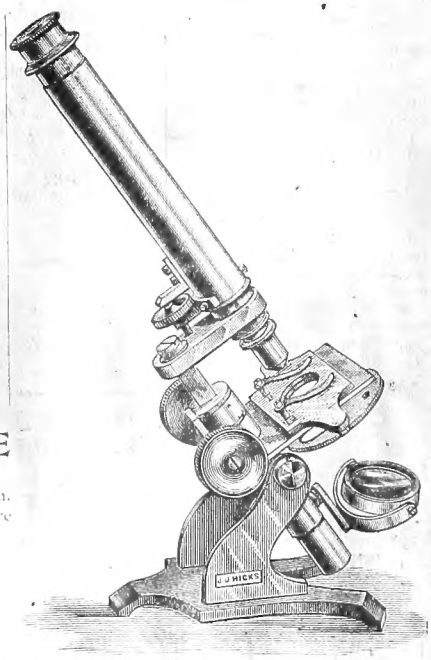

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